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XII

A REVIEW OF THE ALBATROSSES, PETRELS, AND DIVING PETRELS

BY LEVERETT MILLS LOOMIS

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INTRODUCTION

The present paper consists of six parts. Part I is a brief sketch of the men and writings that have been prominent in the advancement of our knowledge of the Tubinares. Part II treats of the geographic distribution of the group. Numerous distribution areas are recognized. Part III has a wider scope. The causes of bird migration are considered from the view point of the migratory movements of the Tubinares. Part IV relates to the variations of these birds in color, size, and external structure. Part V deals with their classification and nomenclature. Part VI is a repository of facts upon which the conclusions in the three preceding parts are largely based. It presents the results of my study of extensive series of the Tubinares and the outdoor observations upon this group made by Mr. Edward Winslow Gifford, Mr. Rollo Howard Beck, and Dr. Alexander Sterling Bunnell during the ocean expeditions sent out by the California Academy of Sciences.

In the preparation of this paper I have received much assistance from institutions and individuals. For the loan of specimens I am indebted to Mr. Outram Bangs, Mr. A. C. Bent, Dr. Joseph Grinnell, Dr. Leonard C. Sanford, Mr. John E. Thayer, the State of Oregon Fish and Game Commission, through Mr. Stanley G. Jewett, the Bernice Pauahi Bishop Museum, through Mr. John F. G. Stokes, the Department of Zoology of Leland Stanford Junior University, through Prof. John O. Snyder, the Museum of Vertebrate Zoology of the University of California, through Dr. Joseph Grinnell, the Carnegie Museum, through Mr. W. E. Clyde Todd, and the United States National Museum, through Dr. Charles W. Richmond. I am also under obligations to Mr. L. R. Reynolds for the photographs of museum specimens reproduced in the accompanying illustrations, to Mr. Samuel Levi for the original drawing of the homolographic chart, to Mr. Edward Winslow Gifford for the great series of measurements, and lastly to my friend of many years, Mr. Ransom Pratt, who has read most of the manuscript of this paper during its preparation, and has made many suggestions that have added to the clearness of the statements.

I

HISTORIC SKETCH

The Pre-Couesian Period: to 1866

Prior to the publication of Dr. Coues's monograph in 1864 and 1866, the literature pertaining to the albatrosses, petrels, and diving petrels was at best fragmentary. The impress of Linnæus upon the group in the tenth and twelfth editions of his *Systema Naturæ* is very slight; only five of the eight specific names proposed by him are tenable. Johann Friedrich Gmelin, "an industrious, indiscriminate compiler and transcriber," in 1789 in volume one, part two, of his edition of the *Systema Naturæ* considerably increased Linnæus's list. The source of Gmelin's information was mainly the third volume of Dr. John Latham's *General Synopsis of Birds,* published in 1785. In this work Latham did not apply "the principles of binary nomenclature," and therefore his names of species have no standing in technical ornithology. In his *Index Ornithologicus,* which appeared in 1790, Latham bestowed Latin binomial names upon his birds. Nevertheless, only one name survives in the group we are considering, for he was forestalled by Gmelin, who followed the Linnæan system of naming, thereby gaining a foothold in the nomenclature.

Latham's name is inseparably connected with the ornithology of Captain James Cook's three voyages, and the present narrative would be incomplete without some further allusion to these voyages. On the first voyage, which lasted from 1768 till 1771, Cook was accompanied by Sir Joseph Banks and his four assistants, Dr. Daniel Carl Solander (a disciple of Linnæus) and three artists, one of whom was Sydney Parkinson, in whose honor Parkinson's Petrel in later years was named. Parkinson made the drawings of the birds and Solander wrote the descriptions and selected the names. Banks and Solander returned in safety, but Parkinson and the other artists died on the voyage. Solander after his return to England elaborated his original notes on the albatrosses and petrels into extensive Latin descriptions ready for the printer, but he died in 1782, leaving them unpublished. Recently these manuscript descriptions have been discovered in the British Museum

by Mr. Gregory M. Mathews, and published by him in the second volume of his *Birds of Australia.* Since the time of Mr. George Robert Gray the manuscript had apparently been lost sight of by ornithologists. Neither Mr. Salvin nor Dr. Godman knew of its existence. On Cook's second voyage (1772-1775) Dr. Johann Reinhold Forster was naturalist, his son Johann Georg Adam Forster (commonly called George Forster) bird artist, and Dr. Anders Sparrman assistant to the elder Forster. In 1785, Forster published his *Mémoire sur les Albatros* in Tome X of *Mémoires de Mathématique et de Physique, présentés a l'Académie Royale des Sciences* [Paris], describing three species. Although catalogued by Carus and Engelmann in their *Bibliotheca Zoologica* and quoted from that work by Dr. Coues in his *Third Instalment of American Ornithological Bibliography,* this memoir was overlooked by nomenclators until 1902 when Mr. C. Davies Sherborn drew attention to it in his *Index Animalium.* Owing to disagreements between the British Government and Forster, the larger results of Forster's work on the voyage remained unpublished during his lifetime. In 1844, under the editorship of Dr. Martin Hinrich Lichtenstein, the results finally appeared in *Descriptiones Animalium.* Priority of technical names was lost in most instances by this long delay. On his third voyage (1776-1780), Cook was accompanied by two artists, William W. Ellis and John Webber. Ellis appears to have made all of the bird drawings on this voyage.

Parkinson's drawings and Solander's manuscript, George Forster's drawings, and Ellis's drawings passed into the possession of Sir Joseph Banks. The specimens obtained on the second voyage went in part to the British Museum, and those on the third voyage, at least, to the collection of Sir Joseph Banks. "Some found their way into the Leverian Museum" (J. E. Gray, Dieffenbach's *Travels in New Zealand,* Vol. II, p. 178). The Leverian Museum was the private museum of Sir Ashton Lever, established in London during the latter part of the eighteenth century, and finally dispersed by auction in 1806. In our particular field, Latham based his descriptions largely upon the collections of the British Museum, of the Leverian Museum, and of Sir Joseph Banks, availing himself of the fruits of Cook's voyages. Even for the time,

Latham's descriptions are vague, for he did not possess in a high degree the gift of recognizing the distinguishing characters of species. In consequence, some of Gmelin's species founded on Latham's descriptions are indeterminable. In the present paper but ten are admitted. Of the specimens described by Latham, only one is now in the possession of the British Museum (cf. Sharpe, *Hist. Coll. Nat. Hist. Depts. Brit. Mus.*, Vol. II, pp. 79, 172). However, the bird drawings of Cook's voyages, long known as the Banksian drawings, are preserved in the British Museum, and together with Solander's manuscript and Forster's descriptions shed a side light upon the identity of the Gmelinian species under review. It should be noted that Latham did not limit the scope of his *General Synopsis* to classification and nomenclature. Under "place and manners" he included the geographic range and habits of the species.

In 1816 and 1817, Louis Jean Pierre Vieillot reviewed the group in the *Nouveau Dictionnaire d'Histoire Naturelle* (Tomes I and XXV, under Albatros and Pétrel), following closely in the footsteps of Gmelin and Latham. Leach's Petrel and the White-bellied Petrel are formally introduced into technical nomenclature. Three years later, in 1820, appeared Dr. Heinrich Kuhl's *Beiträge zur Kenntniss der Procellarien* in part first of his *Beiträge zur Zoologie und vergleichenden Anatomie.* Twenty-seven species and nominal species of petrels and one diving petrel are treated in this monograph. The Capped Petrel and Wilson's Petrel receive technical christening, unwittingly, however, for Kuhl attributed the designation of the former to Forster and of the latter to Banks, basing his identification upon the Banksian drawings. James Francis Stephens in 1826 in Volume XIII of Shaw's *General Zoology* instituted two genera and provided a technical name for the Slender-billed Fulmar. He also adopted a generic name (*Pachyptila*) proposed by Johann Karl Wilhelm Illiger in 1811 in his *Prodromus Systematis Mammalium et Avium.* As a whole, Stephens's treatment of the group falls short of that by his predecessors.

John Gould early became interested in the group. In Volume II of his *Handbook to the Birds of Australia* (1865), he remarks on page 421: "Having paid much attention to

these birds during my passages to and from Australia, my researches were rewarded by my obtaining a knowledge of nearly forty different species, most of which are peculiar to the southern hemisphere, and many of them frequenters of the Australian seas." In the *Proceedings of the Zoological Society of London,* parts for 1840, 1843, and 1844, he described two albatrosses and four petrels. In 1844 he published in the *Annals and Magazine of Natural History* an article *On the Family Procellaridæ, with descriptions of Ten new Species.* Only two of the alleged new species were really new. The descriptions of three other species, however, antedate descriptions that appeared in the *Proceedings of the Zoological Society* for 1844. Life histories are given in his illustrated folio *Birds of Australia* (Vol. VII) and in the *Handbook* before mentioned.

George Robert Gray, long in charge of the bird collection of the British Museum, described four of the species recognized in the present paper, a description appearing in each of the following publications: Dieffenbach's *Travels in New Zealand,* Volume II, 1843; *Proceedings of the Zoological Society of London* for 1853; *Catalogue of the Birds of the Tropical Islands of the Pacific Ocean,* 1859; *The Ibis* for July, 1862. Furthermore, Gray devoted five pages of the third volume of his sumptuously illustrated *Genera of Birds* to a review of the group.

In 1848 appeared Volume VIII of the *United States Exploring Expedition - - - Mammalogy and Ornithology* by Titian Ramsey Peale, a naturalist of the expedition. Five petrels were described as new; one of them, however, had been described previously by J. R. Forster.

In his *Avium Systema Naturale* (1852), Dr. Heinrich Gottlieb Ludwig Reichenbach instituted a number of genera, five of which are adopted in the present review.

Prince Charles Lucien Jules Laurent Bonaparte, at the close of his long career as an ornithologist, presented a classification of the group in *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences* [Paris], Tome XLII, 1856, and in *Conspectus Generum Avium,* Tomus II, 1857. Five of the generic names proposed by him are used in the present connection.

In 1863 in *Muséum d'Histoire Naturelle des Pays-Bas,* 4me Livraison, Dr. Hermann Schlegel published a systematic monograph of forty pages on the *"Procellariae,"* describing two new species and limiting the number of genera to three, thereby following a course opposite to that of Bonaparte.

With Bonaparte and Schlegel closed the Pre-Couesian Period in the study of the albatrosses, petrels, and diving petrels. The quarried stones were now ready to be built into a lasting foundation by a master builder.

The Couesian Period: 1866-1896

Plate 1

The monograph that defines the preceding and the present period was written by a young man who had not attained his twenty-fourth year, Dr. Elliott Coues, an Assistant Surgeon in the United States Army. This monograph was published in five parts in the *Proceedings of the Academy of Natural Sciences of Philadelphia,* as follows:

A critical Review of the Family Procellaridæ: Part I., embracing the Procellarieæ, or Stormy Petrels, March, 1864, pp. 72-91.

A Critical Review of the Family Procellaridæ:—Part II.; Embracing the Puffineæ, April, 1864, pp. 116-144.

A Critical Review of the Family Procellariidæ:—Part III; embracing the Fulmareæ, March, 1866, pp. 25-33.

Critical Review of the Family Procellariidæ:—Part IV; Embracing the Æstrelateæ and the Prioneæ, May, 1866, pp. 134-172.

Critical Review of the Family Procellariidæ;—Part V; embracing the Diomedeinæ and the Halodrominæ. With a General Supplement, May, 1866, pp. 172-197.

Although young in years, Dr. Coues was highly equipped for monographic work in ornithology. He was well grounded in anatomy and was familiar with the Latin, French, and German languages. He had been trained in the Bairdian methods, and already had had experience in monographing groups of birds. He had access to the books and specimens of "the Philadelphia Academy and the Smithsonian Institu-

ELLIOTT COUES AT TWENTY-ONE

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tion," the specimens including the Gould Australian collection and the spoils of the United States Exploring Expedition, reported upon by Peale. In the first three parts of his monograph, Dr. Coues was under the spell of Bonaparte's great name, but in the two final parts he emancipated himself from this influence. The vulnerable points in the monograph are chiefly of the kind incident to lack of specimens and outdoor observation. Dichromatism was mistaken for age variation, and inconstant characters were sometimes misconstrued to be constant ones. Seasonal variation due to wear of plumage, however, was clearly understood. Although other monographs have since appeared, the influence of this monograph has not ceased. It "must always be consulted," remarks Mr. Salvin, "by those wishing to master the intricacies of this complicated subject." Dr. Coues's connection with the group did not wholly terminate with the publication of his monograph. He edited the "Ornithology" and was joint author of the "Oölogy" of Dr. Jerome Henry Kidder's *Contributions to the Natural History of Kerguelen Island* (I, 1875, II, 1876), and he identified the birds of Dr. Thomas H. Streets's *Contributions to the Natural History of the Hawaiian and Fanning Islands and Lower California* (1877). In *Remarks on certain Procellariidæ* (*The Auk,* 1897), he introduced the system of classification for the higher groups followed in the present paper, and in the fifth edition of his *Key to North American Birds,* printed in 1903 nearly four years after his death, he devoted upwards of twenty-six pages to the "Order Tubinares: Tube-nosed Swimmers."

In 1870, in *Fauna Vertebrata nell' Oceano,* Professor Enrico Hillyer Giglioli gave an account of the species of "Procellariadee" observed by him during the voyage of the Italian corvette *Magenta* round the world, including five supposed new species originally described by himself and Count Tommaso Adlard Salvadori in 1868 in Volume XI of *Atti della Società Italiana di Scienze Naturali.* In 1876, in Volume I of Mr. George Dawson Rowley's *Ornithological Miscellany,* appeared two articles from the pen of Mr. Osbert Salvin, entitled *Critical Notes on Procellariidæ,* the first dealing with Parkinson's drawings and the second with the petrels described as new by Giglioli and Salvadori in the paper cited

above. The closing year of the decade saw the publication of Volume 168 of the *Philosophical Transactions of the Royal Society of London,* containing an article by Dr. Richard Bowdler Sharpe on the birds of Kerguelen Island, with field notes by Rev. A. E. Eaton, and a shorter article by Mr. Howard Saunders on the birds' eggs obtained on that island. In 1881, Mr. Osbert Salvin published in the *Voyage of H. M. S. Challenger, Zoology,* Volume II, his final report *On the Procellariidæ collected during the Expedition;* twenty-three species being noticed. In Volume IV of the same publication, followed Mr. William Alexander Forbes's *Report on the Anatomy of the Petrels (Tubinares) collected during the Voyage.* The year 1887 was marked by the appearance of Mr. Robert Ridgway's *Manual of North American Birds,* in which most of the species of the Order Tubinares were considered. In 1888, Sir Walter Lawry Buller brought out Volume II of the second edition of his illustrated *History of the Birds of New Zealand,* with its life histories of numerous Tubinarine species. The same year Mr. Osbert Salvin contributed in *The Ibis* a third instalment of his *Critical Notes on the Procellariidæ,* foreshadowing the close of the Couesian Period.

The Salvinian Period: 1896-1910

Plate 2

The advent in 1896 of the twenty-fifth volume of the *Catalogue of the Birds in the British Museum,* embracing Mr. Howard Saunders's monograph on the "Gaviæ (Terns, Gulls, and Skuas)" and Mr. Osbert Salvin's monograph on the "Tubinares (Petrels and Albatrosses)," ushered in the Salvinian Period. With far greater facilities than those at the command of his predecessor, Mr. Salvin was able to simplify the whole subject and give it a new impetus. The shortcomings of this monograph, as in the preceding one, were due chiefly to lack of specimens and outdoor observation.

The year 1901 witnessed the publication of Mr. Archibald James Campbell's *Nests and Eggs of Australian Birds,* and 1905 Sir Walter Lawry Buller's *Supplement to the Birds of New Zealand,* each containing life histories of numerous antip-

Osbert Salvin.

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F. D. Godman

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odean species of the group under consideration. Also, this period was fruitful in reports of Antarctic and sub-Antarctic exploration. Of special importance are Mr. William Eagle Clarke's *Ornithological Results of the Scottish National Antarctic Expedition* (*The Ibis,* 1905, 1906, 1907), Dr. Einar Lönnberg's *Contributions to the Fauna of South Georgia* (1906), Dr. Anton Reichenow's extended paper in the *Deutsche Südpolar-Expedition* (IX Band, Zoologie, I Band, 1908), and Dr. Edward Adrian Wilson's account in the *National Antarctic Expedition - - - Natural History* (Vol. II, Zoology, 1907). Dr. Wilson accompanied both of the expeditions commanded by Captain Scott, and lost his life in the ill-fated return from the South Pole. Some of the best ornithology that has ever been written about the albatrosses and petrels is to be found in his report.

Mr. Salvin projected an elaborate, illustrated monograph, but he passed away on the 1st of June, 1898, without carrying his plan into effect.

The Godmanian Period: 1910-19—

Plate 3

Dr. Frederick Du Cane Godman, Mr. Salvin's lifelong friend and collaborator in the monumental *Biologia Centrali-Americana,* assumed the task of writing the projected monograph, and with the assistance of Dr. Richard Bowdler Sharpe brought it to a successful conclusion. The *Monograph of the Petrels (Order Tubinares),* issued in five parts (1907-1910), marks a decided advance, creating a new period in the rise and progress of our special subject.

At this point the sketch must be brought to a close, for it has reached the contemporaneous events which fall within the scope of the succeeding parts of this paper.

II

GEOGRAPHIC DISTRIBUTION

General Considerations

THE TUBINARES frequent all the oceans of the world. Only a few species, however, breed both in the Northern and Southern hemispheres. The Southern Hemisphere is the stronghold of the group; fully twice as many species breed there as in the Northern Hemisphere. The Pacific Ocean, likewise, is much more prolific in species than the Atlantic and Indian oceans. The Pelecanoididæ, the albatrosses of the genera *Thalassarche* and *Phœbetria,* and the Fulmarinæ and Oceanitinæ, with the exception of the Fulmar and White-faced Petrel, are peculiar to the Southern Hemisphere. The majority of the Thalassidrominæ and three of the five albatrosses of the genus *Diomedea* are peculiar to the North Pacific. At least half a dozen species breed on the coasts of the Antarctic Continent, namely, the Giant, Slender-billed, and Antarctic[1] fulmars and the Cape, Snowy, and Wilson's petrels. In Arctic regions, the Fulmar breeds as far north as Franz Josef Land and Melville Island, and the Storm Petrel as far north as the Lofoten Islands, Norway. Notable examples of diversity in distribution in intermediate latitudes are presented in the Wedge-tailed Shearwater and White-faced, Bulwer's, and Harcourt's petrels. The known breeding range of the Wedge-tailed Shearwater extends from the Seychelle and Mascarene islands in the Indian Ocean, Australia, and the Kermadec Islands in the southwestern Pacific to the Revilla Gigedo, Hawaiian, and Volcano islands in the North Pacific, and the breeding range of the White-faced Petrel extends from Australian and New Zealand seas to Tristan da Cunha in the South Atlantic and the Cape Verde and Salvage islands in the North Atlantic. Bulwer's and Harcourt's petrels have a more discontinuous distribution. Bulwer's Petrel is known to breed on the Madeira, Salvage, Canary, and Hawaiian islands, and Harcourt's Petrel on the Azores, Madeira, Salvage, Cape Verde, Galapagos, and Hawaiian islands.

[1] Cf. Mawson, Home of the Blizzard, v. 2, pp. 117, 260.

The ancestral line of the Tubinares extends back into the Miocene Period, and the causes affecting the distribution of the group involve past conditions as well as present ones. The preponderance of species in the Southern Hemisphere and on the Pacific Ocean, the restriction of the Pelecanoididæ and certain other groups to Southern seas, and the dual hemisphere distribution of the Wedge-tailed Shearwater and White-faced Petrel are not explained solely by existing conditions. There is an historic background. In the remote past Tubinarine species became established in their habitats and have been able to hold them against all competition. Their success is perhaps due chiefly to the isolated character of their breeding stations, where predaceous land mammals are absent and food is plentiful. The discontinuous distribution of Harcourt's and Bulwer's petrels ceases to be an enigma when viewed from the standpoint of a water way between North and South America, which geologists tell us existed as late as the Miocene Period.

The fact is not lost sight of that temperature is a factor in the geographic distribution of birds. The apparent restriction of certain Tubinares in the Southern Hemisphere to the zone lying approximately south of the isotherm of 15° C. for January perhaps indicates a temperature control. It should be borne in mind, however, that temperature on the ocean is affected not only by latitude, but by periodic winds, warm and cold currents, and apparent upwelling of cold bottom water, and it may be that these persistent phenomena, instead of exercising temperature control, serve merely as boundaries, marking the frontiers of habitats established in ages long past.

Barren areas in the sea and areas having a food-supply also determine distribution. In the former bird-life is wanting and in the latter it may abound, as in the south polar seas, where there exists an extraordinary abundance of food in summer and autumn.[1]

[1] Cf. Clarke, Ibis, 1907, pp. 328, 329.

DISTRIBUTION AREAS

Plate 4

For the Tubinares, I recognize three different grades of distribution areas, namely, *superarea, area,* and *subarea,* based on the species at their breeding stations. A superarea or an area is distinguished by characteristic species, and a subarea by a peculiar association of any of the breeding species of an area.

Superareas

Two superareas are admitted, one embracing the Southern Hemisphere seas and all Galapagos waters, the other the Northern Hemisphere seas exclusive of Galapagos waters. The former is designated the *Southern Superarea* and the latter the *Northern Superarea.* The subjoined lists show the characteristic species. The preponderance of Southern Superarea species and the paucity of those common to both superareas are apparent from a glance in these lists.

Species breeding only in the Southern Superarea

Diomedea exulans
Diomedea irrorata
Thalassarche melanophris
Thalassarche bulleri
Thalassarche cauta
Thalassarche culminata
Thalassarche chlororhynchos
Phœbetria palpebrata
Macronectes giganteus
Priocella antarctica
Thalassoica antarctica
Petrella capensis
Halobæna cærulea
Pachyptila vittata
Pagodroma nivea
Bulweria macgillivrayi
Pterodroma axillaris
Pterodroma leucoptera
Pterodroma brevipes
Pterodroma nigripennis
Pterodroma cooki
Pterodroma externa
Pterodroma cervicalis
Pterodroma lessoni
Pterodroma incerta
Pterodroma neglecta
Pterodroma rostrata
Pterodroma magentæ
Pterodroma macroptera
Pterodroma aterrima
Pterodroma solandri
Pterodroma inexpectata
Pterodroma brevirostris
Procellaria æquinoctialis
Procellaria parkinsoni
Priofinus cinereus
Puffinus gravis
Puffinus creatopus
Puffinus gavia
Puffinus carneipes
Puffinus griseus
Puffinus tenuirostris
Puffinus bulleri
?Oceanodroma markhami
Oceanodroma hornbyi
Oceanites oceanicus
Oceanites gracilis
Pealea lineata
Garrodia nereis
Fregetta melanogaster
Fregetta grallaria
Fregetta albigularis
Fregetta mœstissima
Pelecanoides urinatrix
Pelecanoides garnoti


WRANGELL
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BONIN IS
VOLCANO IS
MARCUS I.
WAKE I.
LADRONE IS.
CAROLINE IS.
MARSHALL IS.
GILBERT IS.
PHOENIX IS.
SEYCHELLE IS.
CHAGOS ARCH.
MASCARENE IS.
NEW HEBRIDES
SAMOAN
FIJI IS.
NEW CALEDONIA
NORFOLK I.
KERMADEC
LORD HOWE I
CHATHAM I.
BOUNTY IS
SNARES IS.
STEWART I.
AUCKLAND IS.
CAMPBELL I.
MACQUARIE I.
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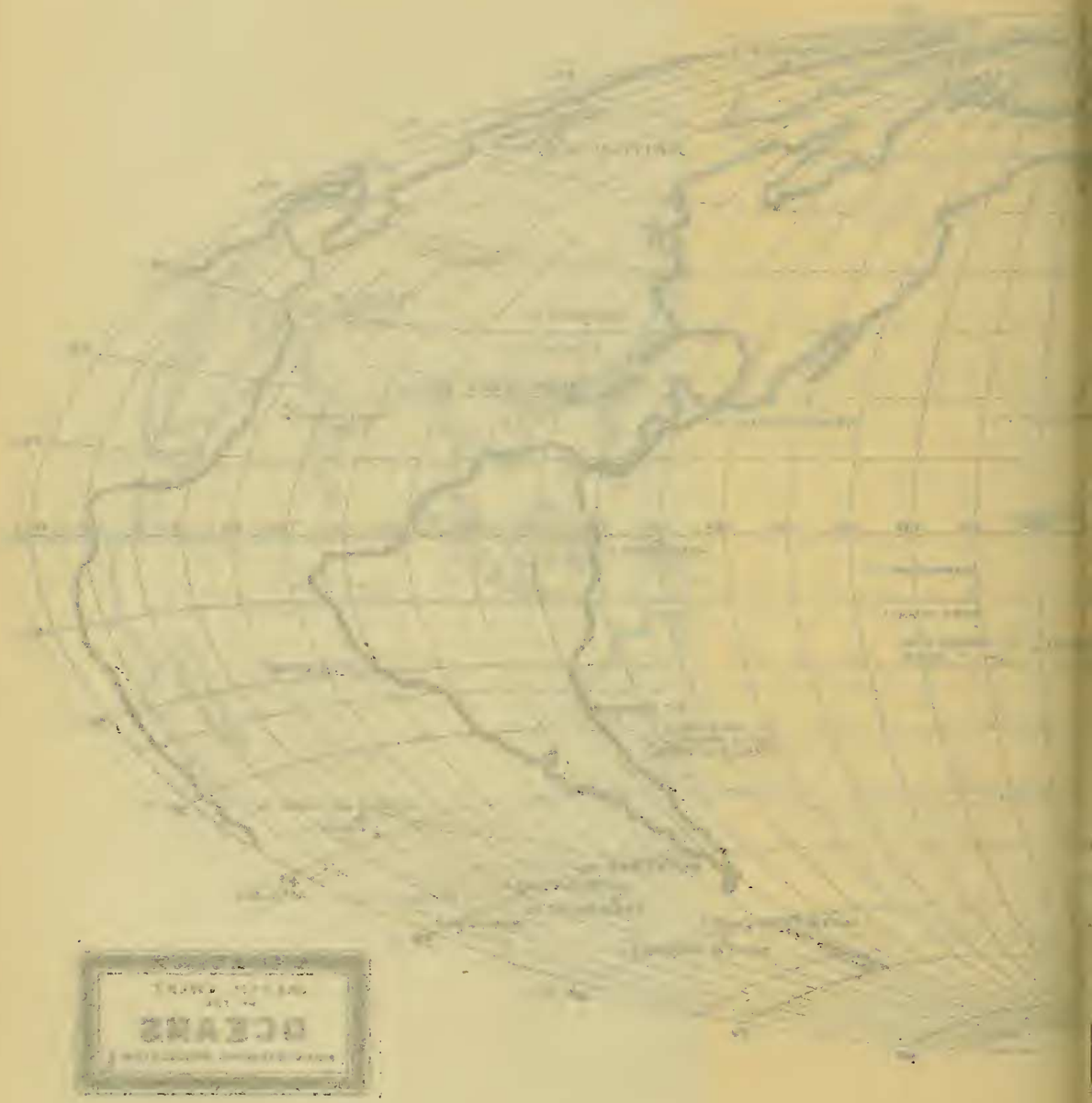

Species breeding only in the Northern Superarea

Diomedea nigripes
Diomedea albatrus
Diomedea immutabilis
Fulmarus glacialis
Bulweria bulweri
Pterodroma hypoleuca
Pterodroma hasitata
Pterodroma caribbæa
Puffinus kuhli
Puffinus puffinus
Puffinus opisthomelas
Puffinus auricularis
?Puffinus leucomelas
Halocyptena microsoma
Thalassidroma pelagica
Oceanodroma macrodactyla
Oceanodroma leucorhoa
Oceanodroma homochroa
Oceanodroma tristrami
Oceanodroma melania
Oceanodroma furcata

Species breeding in Both Southern and Northern Superareas

Pterodroma phæopygia
Pterodroma mollis
Pterodroma parvirostris
Puffinus obscurus
Puffinus nativitatis
Puffinus chlororhynchus
?Oceanodroma tethys
Oceanodroma castro
Pelagodroma marina

Areas

Three areas are recognized in the Southern Superarea, namely, *Circumpolar Area, Indo-Pacific Area,* and *South Atlantic Area,* and two in the Northern Superarea, namely, *North Pacific Area* and *North Atlantic Area.* The boundaries are necessarily more or less tentative, owing to our imperfect knowledge of the breeding stations of many species.

The *Circumpolar Area* lies chiefly between parallels 78° S. and 40° S., and includes Tristan da Cunha, but not Chatham, South, or Stewart islands, New Zealand, or Tasmania. Its northern boundary coincides well with the isotherm of 15° C. for January. The climatic conditions are Antarctic and sub-Antarctic. The following are apparently characteristic species:

Thalassarche melanophris
Thalassarche bulleri
Thalassarche culminata
Phœbetria palpebrata
Macronectes giganteus
Priocella antarctica
Thalassoica antarctica
Petrella capensis
Halobæna cærulea
Pagodroma nivea
Pterodroma lessoni
Pterodroma brevirostris
Procellaria æquinoctialis
Puffinus gravis
Oceanites oceanicus

The *Indo-Pacific Area* embraces approximately the Indian and Pacific oceans south of the Equator and north of the isotherm of 15° C. for January, including the immediate vicinity of Stewart, South, and Chatham islands, New Zea-

land, and the entire Galapagos Archipelago. Characteristic species appear to be the following:

Diomedea irrorata
Bulweria macgillivrayi
Pterodroma axillaris
Pterodroma leucoptera
Pterodroma brevipes
Pterodroma nigripennis
Pterodroma cooki
Pterodroma externa
Pterodroma cervicalis
Pterodroma rostrata
Pterodroma aterrima
Pterodroma solandri
Pterodroma inexpectata
Procellaria parkinsoni
Puffinus creatopus
Puffinus bulleri
Oceanodroma hornbyi
Oceanites gracilis
Pealea lineata
Fregetta albigularis
Fregetta mœstissima
Pelecanoides garnoti

The *South Atlantic Area* comprises the South Atlantic Ocean north of the isotherm of 15° C. for January. Its characteristic species remain to be determined.

The *North Pacific Area* includes the Indian and Pacific oceans north of the Equator (exclusive of Galapagos waters), and extends through Bering Strait into the Arctic Ocean. The characteristic species are:

Diomedea nigripes
Diomedea albatrus
Diomedea immutabilis
Pterodroma hypoleuca
Puffinus opisthomelas
Puffinus auricularis
?Puffinus leucomelas
Halocyptena microsoma
Oceanodroma macrodactyla
Oceanodroma homochroa
Oceanodroma tristrami
Oceanodroma melania
Oceanodroma furcata

The *North Atlantic Area* covers the North Atlantic Ocean and portions of the Arctic Ocean. The following species are characteristic of this area:

Pterodroma hasitata
Pterodroma caribbæa
Puffinus kuhli
Puffinus puffinus
Thalassidroma pelagica

Fulmarus glacialis, Bulweria bulweri, and *Oceanodroma leucorhoa* are common to the North Pacific and North Atlantic areas.

Subareas

The subjoined synopsis indicates the subareas thus far recognized by me. They are, however, largely tentative, for our knowledge of the breeding stations of many species is still very imperfect.

		Subareas
Southern Superarea	Circumpolar Area....	Antarctic Kerguelen Macquarie South Georgia Tristan da Cunha
	Indo-Pacific Area....	Mascarene West Australian East Australian New Zealand Kermadec Juan Fernandez South Polynesian Galapagos
	South Atlantic Area..	Trinidad
Northern Superarea	North Pacific Area...	Hawaiian Revilla Gigedo Californian Southeastern Alaskan Northern Alaskan
	North Atlantic Area.	West Indian Madeiran Mediterranean Nova Scotian Britannic Franz Josef

The *Antarctic Subarea* occupies the region between latitude 78° S. and 60° S., and has a polar climate. The following species are known to breed within its bounds:

Macronectes giganteus
Priocella antarctica
Thalassoica antarctica
Petrella capensis
Pagodroma nivea
Oceanites oceanicus
Fregetta melanogaster

The *Kerguelen Subarea* includes the Kerguelen Group and Heard, Crozet, and Prince Edwards islands. Sub-Antarctic conditions prevail. Breeding species are:

Diomedea exulans
Thalassarche melanophris
Thalassarche culminata
?Thalassarche chlororhynchos
Phœbetria palpebrata
Macronectes giganteus
Petrella capensis
Halobæna cærulea
Pachyptila vittata
Pterodroma lessoni
Pterodroma macroptera
Pterodroma brevirostris
Procellaria æquinoctialis
Oceanites oceanicus
Garrodia nereis
Fregetta melanogaster
Pelecanoides urinatrix

The *Macquarie Subarea* embraces the Macquarie, Campbell, Auckland, Antipodes, Snares, and Bounty islands. The climate is sub-Antarctic, especially in the more southerly islands. The following species breed in this subarea:

Diomedea exulans
Thalassarche melanophris
Thalassarche bulleri
Thalassarche cauta
Thalassarche culminata
Phœbetria palpebrata
Macronectes giganteus
Pachyptila vittata
Pterodroma lessoni
Procellaria æquinoctialis
Priofinus cinereus
Puffinus gavia
Garrodia nereis
Pelagodroma marina
Pelecanoides urinatrix

The *South Georgia Subarea* comprises the sub-Antarctic South Georgia, Falkland, Sandwich, and Bouvet islands. Breeding species are:

Diomedea exulans
Thalassarche melanophris
Phœbetria palpebrata
Macronectes giganteus
?Petrella capensis
Pachyptila vittata
Pagodroma nivea
Procellaria æquinoctialis
Oceanites oceanicus
Garrodia nereis
?Fregetta melanogaster
Pelecanoides urinatrix

The *Tristan da Cunha Subarea* is restricted to the Tristan da Cunha Group and Gough Island, and lies in the zone south of the isotherm of 15° C. for January. The following are said to breed in this subarea:

Diomedea exulans
Thalassarche culminata
?Thalassarche chlororhynchos
Phœbetria palpebrata
Macronectes giganteus
Pachyptila vittata
Pterodroma mollis
Puffinus gravis
Puffinus obscurus
Pelagodroma marina
Pelecanoides urinatrix

The *Mascarene Subarea* consists of the Mascarene, Seychelle, and Chagos archipelagoes. *Pterodroma aterrima, Puffinus obscurus,* and *Puffinus chlororhynchus* breed within its bounds.

The *West Australian Subarea* embraces the north, west, and south coasts of Australia from the Gulf of Carpentaria to Victoria. The following, at least, breed in this subarea:

Pterodroma macroptera
Puffinus obscurus
Puffinus carneipes
Puffinus tenuirostris
Puffinus chlororhynchus
Pelagodroma marina

The *East Australian Subarea* is the complement of the West Australian, embracing Tasmania and the coasts of Vic-

toria, New South Wales, and Queensland. Among its breeding species are:

Thalassarche cauta
Pachyptila vittata
Pterodroma leucoptera
Puffinus tenuirostris
Puffinus chlororhynchus
Pelagodroma marina
Pelecanoides urinatrix

The *New Zealand Subarea* includes North, South, Stewart, and Chatham islands, New Zealand. The breeding species are mainly the following:

Diomedea exulans
Pachyptila vittata
Pterodroma axillaris
Pterodroma cooki
Pterodroma macroptera
Pterodroma inexpectata
Procellaria parkinsoni
Puffinus gavia
Puffinus obscurus
Puffinus carneipes
Puffinus griseus
Garrodia nereis
Pelagodroma marina
Pelecanoides urinatrix

The *Kermadec Subarea* comprises the Kermadec, Norfolk, and Lord Howe islands. Breeding species are:

Pterodroma nigripennis
Pterodroma cervicalis
Pterodroma neglecta
Pterodroma solandri
Puffinus obscurus
Puffinus carneipes
Puffinus chlororhynchus

The *Juan Fernandez Subarea* has within its bounds Juan Fernandez, Masafuera, St. Felix, and St. Ambrosio islands. Breeding species are:

Pterodroma cooki
Pterodroma externa
Pterodroma neglecta
Puffinus creatopus

The *South Polynesian Subarea* comprehends the tropical islands of the central Pacific south of the Equator. Breeding species appear to be:

Bulweria macgillivrayi
Pterodroma brevipes
Pterodroma rostrata
Pterodroma parvirostris
Puffinus obscurus
Puffinus nativitatis
Puffinus chlororhynchus
Pealea lineata
Fregetta albigularis
Fregetta mœstissima

The *Galapagos Subarea* is conterminous with the Galapagos Archipelago. Its breeding species are:

Diomedea irrorata
Pterodroma phæopygia
Puffinus obscurus
Oceanodroma tethys
Oceanodroma castro
Oceanites gracilis

The *Trinidad Subarea* is limited to Trinidad Islet (latitude 20° 30′ S., longitude 29° 15′ W.). *"Pterodroma arminjoniana"* (=*P. neglecta?*) is the only species of Tubinares reported as breeding.

The *Hawaiian Subarea* includes the Hawaiian, Marcus, Volcano, and Bonin islands. It harbors the following breeding species:

Diomedea nigripes
Diomedea immutabilis
Bulweria bulweri
Pterodroma hypoleuca
Pterodroma phæopygia
Puffinus auricularis
Puffinus nativitatis
Puffinus chlororhynchus
Oceanodroma castro
Oceanodroma tristrami

The *Revilla Gigedo Subarea* is coextensive with the Revilla Gigedo Islands. *Puffinus auricularis* and *Puffinus chlororhynchus* breed there.

The *Californian Subarea* comprises the islets off the coast of Lower California and Southern and Middle California. The species known to breed in this subarea are the following:

Puffinus opisthomelas
Halocyptena microsoma
Oceanodroma macrodactyla
Oceanodroma leucorhoa
Oceanodroma homochroa
Oceanodroma melania

The *Southeastern Alaskan Subarea* extends along the coastal islets from Middle California (latitude 41° N.) to the Aleutian Islands. *Oceanodroma leucorhoa* and *Oceanodroma furcata* are the breeding species.

The *Northern Alaskan Subarea* includes the Aleutian Islands and the Bering Sea and Arctic Alaskan islands. The breeding species are:

?Diomedea albatrus
Fulmarus glacialis
Oceanodroma leucorhoa
Oceanodroma furcata

The *West Indian Subarea* consists of the West India and Bermuda islands. *Pterodroma hasitata, Pterodroma caribbæa,* and *Puffinus obscurus* are the breeding species.

The *Madeiran Subarea* embraces the North Atlantic Islands, namely, Cape Verde and Canary archipelagoes, Salvages, Madeira Group, and Azores. Breeding species are:

Bulweria bulweri
Pterodroma mollis
Puffinus kuhli
Puffinus puffinus
Puffinus obscurus
Oceanodroma castro
Pelagodroma marina

The *Mediterranean Subarea* covers the breeding stations of the Mediterranean Sea. Within its bounds breed *Puffinus kuhli, Puffinus puffinus,* and *Thalassidroma pelagica.*

The *Nova Scotian Subarea* reaches northward from Maine and Nova Scotia to southern Greenland. *Oceanodroma leucorhoa* is apparently the sole breeding species.

The *Britannic Subarea* extends from the British Isles and vicinity to the Lofoten Islands, Norway. Within its confines the following species breed:

Fulmarus glacialis	Thalassidroma pelagica
Puffinus puffinus	Oceanodroma leucorhoa

The *Franz Josef Subarea* is confined to the eastern hyperborean breeding stations of *Fulmarus glacialis.*

III

MIGRATION[1]

While the literature of ornithology abounds in references to the albatrosses and petrels as ocean wanderers, but little has been said of them as birds of passage, although they exemplify every cardinal aspect of bird migration, including certain phases that are wanting in birds whose lives are more intimately connected with the land. Some species are apparently stationary, never venturing far from their breeding stations; others perform migrations that stop short of the Equator; others still are transequatorial migrants; others, breeding in the Tropics and subtropics, migrate in a direction not towards, but away from the Equator, breaking all the time-honored book rules for bird migration.

Migration in the Southern Hemisphere

The species of albatrosses and petrels breeding in the Southern Hemisphere far outnumber those breeding in the Northern. Their migration, too, dwarfs the complementary migration of the northern species, and exhibits similar diversity in the direction and extent of the fly-lines. Among the longest are the transequatorial lines of the Sooty Shearwater and among the shortest is the line of the Snowy Petrel of Antarctic regions.[2]

Transequatorial migration has often been misinterpreted. Even within the last three years a well-known writer upon the petrels has hinted that the nesting grounds of the Sooty Shearwaters visiting the ocean off California would ultimately be discovered north of the Equator.[3] The condition of the plum-

[1] Read in part at the thirty-third stated meeting of the American Ornithologists' Union, held in San Francisco, May 18-20, 1915.

My former papers on bird migration were published as follows:

Auk, 1891, v. 8, pp. 50-55; 1892, v. 9, pp. 28-39; 1894, v. 11, pp. 26-30, 94-117.

Proc. Calif. Acad. Sci., 1895, 2d ser., v. 5, pp. 179-210; 1896, v. 6, pp. 2-14; 1900, 3d ser., Zool., v. 2, pp. 278-316; pp. 350-354.

[2] Cf. Wilson, Nat. Antarct. Exp., N. H., v. 2, Aves, pp. 90, 91.

[3] Mathews, Birds Austr., v. 2, p. 98; cf. pp. 14, 90, 103.

In the Ibis for July, 1915, pp. 588, 602, 603, 608, Messrs. Mathews and Iredale state positively that the Sooty Shearwater breeds on Pescadores Islands. Nevertheless, they offer no better evidence than the mere fact that among myriads of these shearwaters occurring in the Northern Hemisphere two individuals, with the base of the bill somewhat denuded of feathers, were taken by a collector from holes during the month of May. It is well known that superannuated sea birds often retreat to the land and that a denuded state of the base of the bill is highly characteristic of such birds.

age and genital organs in these birds proves that they are migrants from the south. On their arrival in spring they are in worn plumage and their genital organs are small. During the succeeding months they undergo a complete and protracted moult, and at the time of the departure of the hosts in autumn they are in fine feather with the genital organs in a high state of erotic development. Furthermore, the period of absence from California waters coincides with the breeding season in the South Temperate Zone. In a former paper I have also dwelt on this phase of bird migration.[1]

The following South Temperate Zone petrels are known to occur regularly in the North Temperate Zone during their exodus-migration:[2] Great Shearwater, Cooper's Shearwater, Flesh-footed Shearwater, Sooty Shearwater, Slender-billed Shearwater, Buller's Shearwater, and Wilson's Petrel. In the same category probably belongs the Mottled Petrel, and perhaps Stejneger's Petrel, for both have been secured in numbers in the North Temperate Zone. The following have been taken there in one or more instances, and may finally prove to be regular migrants from the south with fly-lines that ordinarily fall short of the Tropic of Cancer: Spectacled Albatross, Culminated Albatross, Sooty Albatross, Giant Fulmar, Slender-billed Fulmar, Cape Petrel, Black-tailed Shearwater, Hornby's Petrel, Black-bellied Petrel, and White-bellied Petrel. Such shorter transequatorial migration appears to obtain in the Neglected Petrel, Juan Fernandez Petrel, and Cook's Petrel, all of which have been found more or less numerously on the northeastern Pacific within the Tropics. Parkinson's Petrel reaches Galapagos waters, and may yet be discovered to extend its exodus-migration across the Equator.

Migration confined to the Southern Hemisphere is well exemplified in the Blue Petrel, Antarctic Fulmar, and Snowy Petrel.[3]

In the Galapagos Albatross exodus-migration in a direction not towards, but away from the Equator seemingly prevails.

[1] Proc. Calif. Acad. Sci., 1900, 3d ser., Zool., v. 2, pp. 303-305.

[2] As migration occurs in every month of the year and in breeding birds of both hemispheres, it is apparent that fall and spring migration and southward and northward migration are inadequate terms; hence exodus-migration and return-migration are substituted for them (cf. Proc. Calif. Acad. Sci., 1900, 3d ser., Zool., v. 2, pp. 352-354).

[3] Cf. Mon. Petrels, p. 283; Wilson, Nat. Antarct. Exp., N. H., v. 2, Aves, pp. 83, 90.

Migration in the Northern Hemisphere

The migratory movements of the Northern Hemisphere species of albatrosses and petrels are counterparts of those occurring in the Southern Hemisphere species. Transequatorial migration is represented in Leach's Petrel, and apparently in the Least Petrel, Storm Petrel, Kuhl's Shearwater, and Manx Shearwater, and migration restricted to the Northern Hemisphere is represented in the Fulmar, and probably in the Short-tailed Albatross. The Ashy Petrel, Black Petrel, and Fork-tailed Petrel have definite migratory movements, but their southern limits have not been reported. After breeding on Lower California islands, Black-vented Shearwaters migrate northward along the coast, some of them as far at least as Vancouver Island, their fly-line thus extending about fifteen hundred nautical miles. Black-footed Albatrosses have an eastward and westward exodus-migration as well as a northern one, the two movements covering the North Pacific area above the Tropic of Cancer. In the Southern Hemisphere the general dispersion of Wandering Albatrosses furnishes somewhat of a parallel.

Remote Cause of Migration

Bewildered by the varied migratory movements, the mind is prone to create complications where none exist, and to lose sight of the fact that in each bird, migration is simply an exodus, followed by a return movement to breeding grounds. Migration in one hemisphere is a complement of migration in the other. Exodus-migration in Southern Hemisphere species and return-migration in Northern Hemisphere ones adjust the bird population of the world to southern winter and northern summer, and exodus-migration in Northern Hemisphere species and return-migration in Southern Hemisphere ones adjust the bird population to northern winter and southern summer.

The diversity of the migratory movements evidences that the adjustment of the bird population to the seasons was brought about under stress during a long period of time, the movements in each species being the outcome of a prolonged struggle. Even in the present age the adjustment sometimes

fails. An extraordinary cold wave in a warm temperate region causes great destruction of bird life, suddenly contracting the food area to a degree unprovided for in the ordinary course of migration.[1]

In brief, it is maintained that bird migration is the adjustment of the bird population of the world to the seasons, and that with the unfolding of the seasons came the unfolding of bird migration, the evolution of the seasons being the remote cause of bird migration.[2]

Immediate Cause of Migration

Food

Immediate failure of food plays an important part in the supplemental movements of exodus-migration.[3] These movements may be due to absolute shortage in the food store in the usual winter quarters, or they may be due to the normal fluctuations of the snow and ice line in the territory where winter and summer contend for the mastery, covering up the food-supply of birds that habitually feed on the ground or in the water, forcing them to retreat to a warmer area and to abide there until the snow and ice recede.[4]

The northward migration of Black-vented Shearwaters, after breeding in the subtropics, can not be attributed to immediate failure of food, for species of similar feeding habits, like Townsend's Shearwater and the Wedge-tailed Shearwater, find abundant food in the ocean area deserted by the Black-vented Shearwaters. Neither is the tropical migration of the Least Petrel to be explained on the score of immediate failure in the food-supply.

Long ago, Gilbert White commented on the early exodus-migration in warm temperate regions. In the letter on the Swift, addressed to Daines Barrington, he says: "But in nothing are swifts more singular than in their early retreat. They retire, as to the main body of them, by the 10th of

[1] Cf. Wayne, Auk, v. 16, pp. 197, 198; Clarke, Studies in Bird Migration, v. 1, p. 167.

[2] Season is here used in an historical and not in an astronomical sense. A glacial period would be a phase of the evolution of the seasons.

[3] Variability in abundance due to deflection in the fly-lines of species that form colonies or are restricted in their distribution to small island-like areas is not to be confounded with supplemental migration—cf. Auk, v. 11, pp. 33-39.

[4] Cold has not been emphasized as a factor in supplemental migration, for the species involved apparently thrive in spite of cold if proper food is plentiful.

August, and sometimes a few days sooner; and every straggler invariably withdraws by the 20th: while their congeners, all of them, stay till the beginning of October, many of them all through that month, and some occasionally to the beginning of November. This early retreat is mysterious and wonderful, since that time is often the sweetest season in the year. But, what is more extraordinary, they begin to retire still earlier in the more southerly parts of Andalusia, where they can be nowise influenced by any defect of heat, or, as one might suppose, defect of food. Are they regulated in their motions with us by a failure of food, or by a propensity to moulting, or by a disposition to rest after so rapid a life, or by what? This is one of those incidents in natural history that not only baffles our researches, but almost eludes our guesses!"[1]

In the Western Hemisphere, Cooper's Shearwater of the Eastern Pacific, the Scarlet Tyrant of Argentina,[2] and the Louisiana Water-Thrush of the South Carolina highlands[3] are typical examples of this early exodus-migration.

Immediate failure of food is obviously not the cause of early exodus-migration in warm temperate regions, for in the later movements in these regions the transients from higher latitudes, in certain species, far outnumber the breeding representatives that had previously taken their departure, evincing that the food-supply had suffered no diminution. In resident species, the replacing of the breeding birds of a locality by individuals of the same species from higher life zones bears directly upon this point.

In the return-migration, it is also apparent that immediate failure of food is not the cause of the evacuation of the warmer areas of either hemisphere. Sooty Shearwaters might linger in force in the North Temperate Zone with the Black-vented Shearwaters if present supply of food alone was concerned.[4]

Viewed in the light of the foregoing facts, it is evident that failure of food is not the immediate cause of a large part of migration.

[1] In this relation, see migration reports Bull. Brit. Orn. Club on the early exodus movements of the Swift.
[2] Cf. Hudson, Argentine Ornithology, v. 1, p. 154.
[3] Auk, v. 9, p. 34.
[4] It is sometimes urged as a cause of return-migration that a special food is required for nestlings, which can be obtained only at the breeding stations. The fallacy of this argument is particularly obvious when applied to transequatorial migration.

Inheritance

In the attempts to explain bird migration, inheritance has often been made to bear the whole burden of the matter. It has even been held that young birds but a few weeks from the nest possess faculties that enable them, without the guidance of their seniors, to perform journeys to definite destinations, in some instances thousands of miles distant. This belief arose from a partial knowledge of the facts of migration, like the belief in transformation and hibernation[1] at an earlier period; it was assumed that the young weak-winged birds that drop out of the ranks migrate alone, arrested migration thus being mistaken for migration. Even at this late day, the magic words, sense of direction, instinct, "inherited but unconscious experience," linger in the literature as answers to the questions: How, and why do birds migrate?

The novel experiments of Dr. John B. Watson with Noddy and Sooty Terns at the Dry Tortugas here demand attention. Dr. Watson sums up the results of his experiments as follows: "I think that these tests are significant. The return from Cape Hatteras is really startling. Cape Hatteras is hundreds of miles outside the range of distribution of the noddy and sooty terns. If my statement that the birds rarely leave the islands for distances greater than 15 knots for purposes of feeding corresponds with the facts, it becomes extremely improbable that they could have formed visual associations throughout such a vast territory as that described in these experiments. While these experiments are not in any way crucial, the facts obtained from them are extremely difficult for current theories of distant orientation to explain."[2]

In penning this paragraph Dr. Watson evidently lost sight of a preceding paragraph in his paper, in which he says: "Nearly all of the statements concerning the habits of these birds, like my own, refer to the nesting season. So far as I know to the contrary, almost nothing is known of their life outside of this period. Many of the reactions during the nesting season could be understood more easily if we knew the complete history of their life-cycle."[3]

[1] Curiously enough, this old belief has recently been given credence; cf. Condor, 1917, pp. 7, 8, 26.
[2] Pap. Tort. Lab. Carn. Inst. Wash., 1908, v. 2, p. 230.
[3] L. c., p. 191.

As is well known to the student of migration, water birds nesting in the Tropics and subtropics are inclined after breeding to invade outlying areas higher in latitude. Examples in other groups than the albatrosses and petrels are found in Xantus's Murrelet, Heermann's Gull, Elegant Tern, and California Brown Pelican. The Sooty Tern has even wandered as far north as Maine. With the North American Continent on the west and the Gulf Stream with its varied phenomena on the east, it would be no great feat for a Sooty Tern to wing its way over familiar waters intervening between Cape Hatteras and the nesting station on the Dry Tortugas.

Since the above was written, Dr. Watson has published another extended paper on the homing of Noddy and Sooty Terns of the Dry Tortugas.[1] As in his first paper, his conclusions are reached without definite data concerning the distribution and movements of these terns after the breeding season, and without any data whatsoever concerning the route followed by the captive birds after their liberation at various remote points on the Gulf of Mexico. The birds were liberated, and some of them arrived at their breeding station. Between these two events no observations were made, and therefore it was not determined what did, or did not, guide the birds in their return passage. The coast-line, the Gulf Stream, the great volume of fresh water that pours into the Gulf of Mexico from the Mississippi and other rivers, the temperature of the surface water inshore and offshore, the trade-winds, and the land- and sea-breezes are a part of the every day life of birds frequenting the Gulf of Mexico, and there is no evidence that these physical phenomena do not direct the birds in their local and migratory movements. Observance of birds actually migrating is the real key to how birds find their way.

The evidence does not warrant the assumption that migratory birds are endowed with extraordinary faculties. The facts show that birds possess in an eminent degree the faculty to remember places and direction, that they have great visual powers, and that they keenly sense slight differences in temperature, and that migratory birds probably have in addition to these heritages an innate desire for travel (*wanderlust*).[2]

[1] Pap. Dept. Mar. Biol. Carn. Inst. Wash., 1915, v. 7, pp. 5-60.
[2] See Proc. Calif. Acad. Sci., 2d ser., v. 6, p. 13, footnote; 3d ser., Zool., v. 2, p. 315.

Thus equipped, a young Black-vented Shearwater reared on Natividad Island, Lower California, would have to learn when and where to go if he took part in the exodus-migration leading northward to the latitude of Vancouver Island, British Columbia. Return-migration would be a simpler task, for the young shearwater would have less to learn.

Some writers, clouding the issue, have separated return-migration from exodus-migration, and have held that desire for procreation and special physiological demands as to temperature during reproduction are paramount causes. Desire for procreation does not prompt sedentary species to migration; nor does a waning desire prompt birds-of-the-year to exodus-migration; nor do special temperature requirements prompt the transequatorial migrants that leave regions having a temperature similar to the temperature at the breeding stations. Above and behind the alleged physiological incentives are paramount causes. Without previous experience, the young Sooty Shearwater performs an exodus-migration to the North Temperate Zone and a return-migration to the South Temperate Zone.

It is not in return-migration, but in exodus-migration in a direction opposite to the Equator, in early exodus-migration in warm temperate regions, and in transequatorial migration that we find the supreme test for all explanations of the cause of bird migration.

Education

Guidance by Old Birds.—Arrested migration has been the chief stumbling-block in the way of philosophers who have sought to interpret bird migration. Most reports on migration relate not to migrating birds, but to birds that have halted by the way. No real conception of migratory movements can be gained unless the birds are observed actually *in transitu.* Viewing arrested exodus-migration from very different bird-watching stations, some have reached the conclusion that the young-of-the-year migrate earlier than the adults, and others that the adults migrate earlier than the young-of-the-year.[1] When

[1] Cf. Gätke, Heligoland as an Ornithological Observatory, 1895, p. 102; Stone, Proc. Acad. Nat. Sci. Phila., 1896, p. 110; Dwight, Ann. N. Y. Acad. Sci., 1900, v. 13, pp. 127, 129; Clarke, Studies in Bird Migration, 1912, v. 1, pp. 26, 142, 196, 308, v. 2, p. 55.

migration is studied on the ocean, the cause of these diametrically opposite conclusions is apparent, for upon the ocean the veil is removed and birds are seen in the act of migrating.[1] Extensive migratory movements of old and young birds occur in broad daylight at a slight elevation above the surface of the water. Young birds, weak of wing, drop out of such movements in the exodus-migration, and are often the first birds seen by the observer stationed on or near the land, the offshore flights wholly escaping notice. It is held, therefore, that the preponderance of young-of-the-year, early or late in the exodus-migration, merely evidences that they have stopped by the way, and will later join experienced travelers and resume the journey.[2]

Guidance by Physical Phenomena.—The series of observations made by myself on the ocean in the vicinity of Point Pinos, California, demonstrate that the shearwaters passing that headland in the return-migration are guided in their course by the landmarks.[3] Repeated observations showed that the low fogs deflected their migratory movements toward the land, and when the land as well as the sea was hidden by the fog the migratory hosts became bewildered and lost their way, and when the fog lifted and the landmarks became visible again they immediately resumed their journey, manifesting that they were not endowed with a mysterious sense of direction, but were dependent upon physical phenomena for guidance.[4] The last link in the chain of evidence proving guidance by physical phenomena will be forged when return-migration to breeding stations on islands remote from continents has been studied by a trained student of migration. In the meantime there is no valid justification for lapsing into superstition under the guise of science. We know that the oceans have areas of abundant food where birds are numerous and areas

[1] See my migration papers in Proc. Calif. Acad. Sci.; cf. Clarke, Studies in Bird Migration, v. 2, pp. 6, 11-15; Patten, Zoologist, 1913, pp. 189, 190.

[2] It should be borne in mind that the latitudinal limit of the range of a species is not necessarily the longitudinal limit of its fly-line, and that the mere presence of the young near the upper limit of the breeding range is far from being conclusive proof that the young were reared in the locality.

[3] Consult my detailed account, Proc. Calif. Acad. Sci., 3d ser., Zool., v. 2, particularly pp. 281, 284, 285, 307-309.

[4] In the vicinage of Point Pinos, breeding cormorants, fishing offshore, had no difficulty in finding their way through the fog back to their rookeries, nor did my boatman experience any difficulty in finding his way through the fog from the ocean to Monterey; both had kept their bearings. The shearwaters migrating down the coast, however, had no opportunity of determining their position by local landmarks, and in consequence lost their way. In this connection, see Cooke, Bull. No. 185, U. S. Dept. Agric., pp. 27-29.

where food is wanting and birds absent, and we know that there are prevailing ocean and air currents. It is in these currents, I believe, that we shall find the chief physical phenomena guiding birds in their return-migration to islands remote from continental areas, on the ocean prevailing water and air conditions supplementing landmarks. It is a significant fact that the southern limit of the Black-footed Albatross's range coincides well with the northern limits of the northeast trade-winds.[1]

In accordance with the facts set forth above, it is asserted that the example[2] of the adults would suffice to teach the way to a young Black-vented Shearwater, or Black-footed Albatross, imbued with a desire for travel and keenly alive to physical phenomena; migration being the result of individual experience, at most only the tendency to migration being inherited.

Habit

After the way had been learned by the bird-of-the-year and a probable innate desire for travel had developed into migration, the habit of migration would be formed and become second nature in each bird, holding it true to time and place.

The force of habit is thus succinctly stated by Dr. C. Lloyd Morgan: "In its early days the developing animal is reading the paragraph of life. Every sentence mastered is built into the tissue of experience, and leaves its impress on the plastic, yet retentive brain. By dint of repetition, the results of acquisition become more and more firmly ingrained. Habits are generated; and habit becomes second nature. The organism which to begin with was a creature of congenital impulse and reaction becomes more and more a creature of acquired habits. It is a new being, but one with needs not less imperious than those with which it was congenitally endowed."[3]

[1] See part VI, also Barrett-Hamilton, Ibis, 1903, p. 320, and Salvin, Voy. Chall., Zool., v. 2, pt. 8, p. 147.

Furthermore, winds prevailing for the time being may afford a means of guidance to low-flying migrants journeying across narrow seas; cf. Clarke, Studies in Bird Migration, v. 1, pp. 172, 173, 176-178, v. 2, pp. 12, 28, 29.

[2] In some instances, at least, direct leadership seems to be exercised. In a former paper (Proc. Calif. Acad. Sci., 2d ser., v. 5, p. 198) I cited an instance where a Sooty Shearwater apparently ordered a flank movement in a whole column of Sooty Shearwaters. The intelligence of migrants, I believe, is generally much underrated; in supplemental movements, at least, there appears to be an appreciation of the necessity for migration.

[3] Nature, 1898, v. 57, p. 329.

SUMMARY OF CONCLUSIONS

It is maintained:

1. That bird migration had its origin in the evolution of the seasons, and that it is now the adjustment of the bird population of the world to the seasons.

2. That a large part of migration occurs independently of an immediate failure of food; that inheritance involves at most an innate desire for travel; that the young learn to migrate through the example of the adults; that the adults are guided by physical phenomena over areas that experience has rendered familiar; that migration in its finality becomes in each bird an impelling habit: *therefore, a bird that has passed the stage of dependency migrates because it was born of a race of migrants, and has followed the example of its elders until migration has become second nature.*

In short, it is contended that the causes of bird migration are ascertainable facts and not impenetrable mysteries lying beyond the domain of scientific enquiry.

IV

VARIATION

Age and Seasonal Variation

Natal Down.—Mr. Pycraft has described at some length the double natal down occurring in the Tubinares.[1] He designates the outer segment the protoptyle generation and the inner segment the mesoptyle generation. As alternative names, I suggest primary natal down and secondary natal down. The following diagram emphasizes these distinctions:

Natal down or neossoptyles { Primary natal down or protoptyles / Secondary natal down or mesoptyles

The specimens in double natal down examined by me belong to fifteen species, namely, Black-footed Albatross, Galapagos Albatross, Laysan Albatross, White-breasted Petrel, Sunday Island Petrel, Black-vented Shearwater, Townsend's Shearwater, Dusky Shearwater, Guadalupe Petrel, Harcourt's Petrel, Leach's Petrel, Ashy Petrel, Black Petrel, Fork-tailed Petrel, Garnot's Diving Petrel.

Mr. Pycraft's statement that it is extremely difficult to distinguish the two generations of natal down in the albatrosses[2] is not corroborated in the three albatrosses mentioned above, the generations being well defined in each of them.

If the primary and secondary natal down are not concolor, the wearing off of the primary natal down changes the color aspect of the nestling.

Postnatal Plumages.—In certain species of Tubinares the juvenal plumage[3] is similar in color to the adult one, as in the Sunday Island Petrel; in certain other species the color of these plumages differs widely, as in the Short-tailed Albatross. Much remains to be learned in this group respecting the stages of plumage in the progress to maturity.

Moult.—So far as I am aware, the moult of the Tubinares has received but casual attention from ornithologists, Dr. Dwight, the leading American authority on the moult of birds, and other moult specialists having confined their investigations

[1] Godman's Mon. Petrels, pp. xvii, xviii.
[2] Godman's Mon. Petrels, p. xviii.
[3] In part, I have followed Dr. Dwight's terminology of plumages and moults.

to different orders. In the preparation of part VI of the present paper, I have studied the moult in over two thousand specimens of albatrosses and petrels. This series, however, was collected without reference to moult, and in consequence is deficient in many respects. Specimens taken from day to day and studied in the flesh would have yielded far better results.

In some species at least, the postnuptial moult of the Tubinares begins before the birds leave their nesting grounds, as in the Galapagos Albatross and Townsend's Shearwater. Of the duration of this moult in individuals, I have no definite information, but in certain species, as in the Sooty Shearwater, I have found it protracted over most, if not all, of the year. Throughout its course very different stages are manifested in specimens of the same species taken on the same day. This diversity is accounted for in part by the fact that the individuals of Tubinarine species differ to a greater or less extent in the time of their breeding, even in temperate regions. As no two birds are exactly alike, it is self-evident that moulting in any species must vary more or less in different individuals independent of their age, the state of their health, or the time of their breeding.

Owing to the protraction of the postnuptial moult period, I have been unable to determine positively from the material at my command whether there occurs or not a limited prenuptial or a deferred limited postjuvenal moult. It is apparent that the Tubinares offer a most inviting field for moult study.

Wear of Plumage.—The changes wrought by fading and abrasion are so great in the Tubinares that the descriptions of certain species are incomplete unless they describe both worn and fresh plumages. Through wear, deep brown becomes decidedly paler, as in the Antarctic Fulmar[1]; dark gray browns, as in the Sooty Shearwater; washing or frosting vanishes, unvailing a darker color, as in Cook's Petrel; blooms fade, as in the storm petrels; light tips are lost, causing uniformity in coloration, as in the Mottled Petrel; dark tips disappear, sometimes exposing basal white and enlarging white areas, as in the Black-footed Albatross. Even before the postnuptial moult ends, the destructive changes in the new plumage are apparent, as in Cooper's Shearwater. Obviously, specimens taken at

[1] Wilson, Nat. Antarct. Exp., N. H., v. 2, Aves, p. 83.

breeding stations can not be relied upon implicitly to furnish typical examples of geographic or other variations in color.

Bill.—There is considerable variation in the size and proportions of the bill in certain species of Tubinares. In part it appears to be caused by age, as in the Black-footed Albatross and Short-tailed Albatross. Whether the bill variations in the breeding specimens of the Galapagos Albatross, described in part VI, are due to age or to individual variation is not clear. The color of the bill, too, varies with age in some species. Our knowledge on this point, however, is very deficient, and information regarding it is greatly to be desired, especially in the genus *Thalassarche.*

Sexual and Individual Variation

The sexes in the Tubinares are alike in the color of their plumage, so far as I have ascertained, but differ in certain species in size; for example, the dimensions of the females average somewhat less than those of the males in the Black-footed Albatross, Short-tailed Albatross, and Fulmar.

In parts V and VI numerous instances of apparent individual variation in the color, form, and size of the Tubinares are commented upon. The variation in size is so great that many species overlap in their dimensions. A specially notable example of variation in form occurs in Cooper's Shearwater; the tarsus is not invariably compressed and sharp in front, an alleged generic character thus proving inconstant. A common variation in color is the intrusion of white in dark areas and of a dark color in white areas.

In some cases, owing to lack of proper specimens, I am unable to distinguish individual from dichromatic and age variation, as in the extension of the color of the sides of the neck across the jugulum in numerous specimens of the Dark-rumped Petrel and in the variability in the relative length of the first primary in the Christmas Island Shearwater. Because of the difficulty in determining maturity, it is a question whether age variation in birds is not sometimes mistaken for individual variation.

As shown in the subjoined table, supernumerary rectrices are perhaps not so exceptional as to justify their classification under abnormal instead of individual variation.

No.	Sex	Species	No. of Rectrices
C. A. S.			
1288	♂	*Diomedea nigripes*	Fourteen
1237	♀	*Diomedea irrorata*	Thirteen
1003	♂	*Pterodroma phæopygia*	Thirteen
1004	♂	" "	Fourteen
1138	♂	*Pterodroma inexpectata*	Thirteen
9308	♂	*Puffinus creatopus*	Thirteen
854	♂	*Puffinus obscurus*	Fourteen
9577	♂	*Puffinus griseus*	Thirteen
9743	♂	*Puffinus tenuirostris*	Fourteen
Univ. Calif.			
18682	♂	*Puffinus bulleri*	Fourteen
18685	♂	" "	Thirteen

DICHROMATISM

Dual coloration is a dominant condition in many Tubinares. In the nestling of the Galapagos Albatross (see plates 9, 10, 11 and description in part VI), in the Giant Fulmar, Fulmar, Short-footed Petrel, Neglected Petrel, and Wedge-tailed Shearwater the bicoloration has been proven to be dichromatic. In the following species, dwelt upon at length in parts V and VI, the character of the variation remains to be fully determined: Wandering Albatross, Sooty Albatross, Cape Petrel, Dark-rumped Petrel, Downy Petrel, Cooper's Shearwater, Manx Shearwater, Black-vented Shearwater, Forster's Shearwater, Dusky Shearwater, Sooty Shearwater, Slender-billed Shearwater, Leach's Petrel (including "Kaeding's" and "Socorro" petrels), White-bellied Petrel, and Diving Petrel. The status of the Caribbean Petrel is also in question.

Long ago it was pointed out by Dr. Stejneger[1] that there exists a difference in the geographic range of the light and dark phases of the Fulmar during the breeding season. There is also a geographic distribution in the phases of the Wedge-tailed Shearwater. In the Hawaiian Archipelago the light phase prevails almost exclusively, but on San Benedicto Island, Revilla Gigedo Group, only a minority are of the light phase. The light phase of the Red-footed Booby, on the contrary, is the dominant form in the Revilla Gigedo Group, and on the Galapagos Islands the dark phase is in the ascendency. Fur-

[1] Bull. U. S. Nat. Mus. No. 29, 1885, p. 93.

thermore, the Wedge-tailed Shearwater appears to be represented only by the dark phase on the Kermadec Islands. According to Dr. Edward A. Wilson, the percentage of Giant Fulmars of the light phase increases with the latitude, the greatest number being observed where the ice conditions are persistent.[1] It is evident that the geographic distribution of the light and dark phases of the Tubinares is independent of climatic conditions.

In part VI I have described an instance of complete melanism in the Black-vented Shearwater. This specimen and extreme white specimens of the same species have an appearance similar to that of the light and dark phases of the Wedge-tailed Shearwater (plates 15, 17). If such sporadic melanism, through the virility of an individual, persisted on an island, at the outset there might be a melanism restricted to relatively few individuals, as in the dichromatism of the Wedge-tailed Shearwater in the Hawaiian Archipelago. Later, if the melanistic phase largely swamped the light phase, the result might be as in the Wedge-tailed Shearwater on San Benedicto Island. Ultimately, if the melanistic phase supplanted the light phase, the situation might be like that in the Wedge-tailed Shearwater on the Kermadec Islands. In brief, if sporadic melanism became an inherited character, there would result a persistent melanism, or dichromatism.

Geographic Variation

The isolation of the Tubinares at the breeding stations favors colony peculiarities; for example, in the dark phase of the Wedge-tailed Shearwater breeding on the Kermadec Islands the bill is generally grosser than in the dark phase of this species breeding on San Benedicto Island, Revilla Gigedo Group. According to the tables of measurements in part VI, the "Socorro Petrels" of the Los Coronados Islands, Lower California, average greater in their dimensions than the "Socorro Petrels" of the San Benito Islands, about 250 nautical miles to the southward. In the shearwater, and perhaps in the storm petrel, the geographic variation is overshadowed by dichromatic variation. The Dark-rumped Petrel in the Gala-

[1] Nat. Antarct. Exp., N. H., v. 2, Aves, p. 96.

pagos and Hawaiian archipelagoes apparently exemplifies geographic variation in both color and size. As of other variations in the Tubinares, our knowledge of geographic variation is far from being complete, and all the facts respecting its extent will not be known until series of specimens from all the breeding stations of each species have been thoroughly studied.

Recent systematists appear to be unaware of the wide range of variation existing in the species of the Tubinares and have considerably augmented the synonymy of the group by mistaking unstable for stable characters.

V

CLASSIFICATION AND NOMENCLATURE

General Observations

Species.—Bird species are realities, not concepts, and their identification is not in any way dependent upon a knowledge of their distribution. A bird species presents a peculiar assemblage of characters that separates it from all other bird species as absolutely as one island is separated from all other islands. A bird species may vary but little, as the Laysan Albatross, or it may have a wide range of variation, as the Wedge-tailed Shearwater; for it is not degree of variation, but absence of intergradation that gives specific value to characters.

Groups of Species.—In nature, groups of bird species abound, but there is not sufficient coördination among them to permit any arrangement that is not largely arbitrary. Under such conditions, it is not surprising that systems have multiplied, and that there exists to-day much diversity of opinion respecting taxonomic values. These points are well illustrated in the following schemes of classification of the albatrosses, petrels, and diving petrels:

Mr. Evans (*Cambridge Natural History*, Vol. IX; essentially Dr. Gadow's Scheme in Bronn's *Thier-Reichs*)

Order Procellariiformes Suborder Tubinares Procellariidæ { Diomedeinæ, Oceanitinæ, Procellariinæ, Pelecanoïdinæ

Mr. Salvin (Monographs of Mr. Salvin and Dr. Godman)

Order Tubinares { Procellariidæ { Procellariinæ, Oceanitinæ; Puffinidæ { Puffininæ, Fulmarinæ; Pelecanoididæ; Diomedeidæ

DR. COUES (*Auk*, 1897, p. 314)

Order Tubinares
- Diomedeidæ
- Procellariidæ
  - Fulmarinæ
  - Puffininæ
  - Procellariinæ [=Thalassidrominæ]
  - Oceanitinæ
- Pelecanoididæ

Dr. Coues's classification of these higher groups appears to me to be the most satisfactory, and I have therefore adopted it in the present paper. It is well to recall that Dr. Schlegel treated[1] the albatrosses, petrels, and diving petrels as three genera, designating them respectively, *Diomedea, Procellaria,* and *Halodroma.*

In genera, I have followed, with one exception (*Thalassogeron*), the conventional genera of the monographs of Mr. Salvin and Dr. Godman. I feel, however, that too many have been recognized, especially monotypic ones founded on minor structural characters of species. Subgenera are given no place whatsoever. Where convenience ceases in a classification that is largely arbitrary, it is maintained that no vantage ground is gained by burdening the memory with a multitude of minor divisions and subdivisions.

While I believe that both superficial and deep-seated characters should be utilized in the definition of higher bird groups, I heartily agree with Dr. Reichenow[2] that the genealogy of birds is a subject to be considered apart from bird classification.

The Subspecies Question.—In theory, subspecies are incipient species; in fact, subspecies are attempts to forecast the future of geographic variation, which no one can foresee. Naturally, much difference of opinion has arisen in the application of the subspecies theory. Some ornithologists would differentiate all discernible geographic variation into subspecies; others would make selections and have "practical subspecies." Under the first method the separations become so fine that even typical examples can scarcely be determined.

[1] Mus. Pays-Bas, v. 6, Procell., 1863, pp. 39, 40.
[2] Die Vögel, v. 1.

Under the second method the separations rest largely on the shifting sands of individual opinion. It is obvious that the subspecies theory has complicated, not simplified, the study of birds. Nevertheless, the theory has served a highly useful purpose; it has revealed to ornithologists geographic variation, which is a variation within the limits of the species. In the present paper geographic variation is considered in connection with the other variations of species, the subspecies theory being discarded as a theory that has outlived its usefulness.[1]

Systematic Account

In the succeeding pages the sequence of the species has been considerably changed from that followed by Mr. Salvin and Dr. Godman in their monographs, but it still remains largely provisional. Departures have also been made from the nomenclature employed by these authors, particularly in names where the law of priority was not enforced. Furthermore, numerous names of supposed species recognized by Dr. Godman have been consigned to synonymy. In certain doubtful cases, names have been put in limbo with a query, as the surest means of hastening a final decision as to their standing.

In the analytical keys to the species I have employed structural characters wherever available, thus avoiding repetition by eliminating color variations. I am reminded by long experience as a student of ornithology that artificial keys to birds often fail to unlock. Much care has been bestowed on the present keys, but in some of the species I have been hampered in the determination of distinguishing characters by lack of specimens; in consequence the keys must be regarded, in a measure, as tentative.

In part VI will be found the synonymy and comments on nomenclature of the species that are mentioned only by name in the present part. The synonymy relates to the monographs of Dr. Coues, Mr. Salvin, and Dr. Godman.

With the exception of the few diving petrels, all of the specimens were measured by Mr. Edward Winslow Gifford. The method of measurement is described in detail in the foreword of part VI.

[1] Cf. Auk, 1903, v. 20, pp. 294–299.

TUBINARES: Tube-nosed Swimmers

Key to the Families

Nasal tubes not united, separated by culmen.....**Diomedeidæ**
Nasal tubes united, not separated by culmen
  Tubes horizontal, or nearly so.....**Procellariidæ**
  Tubes vertical .....**Pelecanoididæ**

DIOMEDEIDÆ: Albatrosses

Key to the Species

Tail rounded and ramicorn without longitudinal groove
  Latericorn not decidedly widest at base and upper mandible not compressed at base
    Feathers at base of lower mandible extending beyond base of nasal tubes .....*Diomedea exulans*
    Feathers at base of lower mandible not extending beyond base of nasal tubes
      Cervix dark
        Bill dark .....*D. nigripes*
        Bill light .....*D. albatrus* (young)
      Cervix not dark, being yellow, or white more or less tinged with yellow
        Lores not dark
          Breast and abdomen white.....*D. albatrus* (old)
          Breast and abdomen closely vermiculated with gray or brown and white .....*D. irrorata*
        Lores dark
          Lower parts white .....*D. immutabilis*
  Latericorn decidedly widest at base and upper mandible compressed at base
    Culminicorn and latericorn not separated basally by membrane .....*Thalassarche melanophris*
    Culminicorn and latericorn separated basally by membrane
      Basal width of latericorn less than one and a half times basal width of culminicorn .....*T. bulleri*
      Basal width of latericorn more than one and a half times basal width of culminicorn
        Culminicorn rounded basally
          Latericorn light .....*T. cauta*
          Latericorn dark .....*T. culminata*
        Culminicorn pointed basally.....*T. chlororhynchos*
Tail wedge-shaped and ramicorn with longitudinal groove.....
.....*Phœbetria palpebrata*

Diomedea exulans *Linnæus:* Wandering Albatross

Coues—*Diomedea exulans,* V, 175, 187.
Salvin—*Diomedea exulans,* 440, 441; *Diomedea regia,* 440, 443; *Diomedea chionoptera,* 440, 443.
Godman—*Diomedea exulans,* liii, 309, pl. 89; *Diomedea regia,* liii, 319, pl. 90; *Diomedea chionoptera,* liii, 322, pl. 91.

Mr. Salvin has interpreted an extreme white phase, long attributed to *Diomedea exulans,* to be an undescribed species,

christening it *"Diomedea chionoptera."*[1] An albatross (No. 11342) in the Academy's collection, obtained from a French sailor on the bark *Guerveur* and said by him to have been captured during January, 1908, in latitude 48° S., longitude 50° W., agrees with Mr. Salvin's description of *"D. chionoptera,"* save in the coloration of the back, which is not free from faint vermiculations. This specimen also has irregular traces of gray on the tail, evidencing that it is not in the highest plumage; being merely in a transitional stage. Another specimen (No. 11341 C. A. S.) from the same locality has the appearance of an immature bird. The crown is heavily clouded with sooty brown, the hind neck is obscurely vermiculated, the back is distinctly vermiculated, and the white of the inner webs of the primaries is concealed. No. 15548 U. S. Nat. Mus. is intermediate between the two Academy specimens, the three examples forming a succession terminating in the high *"D. chionoptera"* plumage.

No. 11341: Wing 670 mm.; tail 207; culmen 160; depth of upper mandible 41.5; width of upper mandible 40.6; tarsus 108; middle toe and claw 158.

No. 11342: Wing 670 mm.; tail 215; culmen 167; depth of upper mandible 42.3; width of upper mandible 44.8; middle toe and claw 169.

In supporting the claim of *"D. chionoptera"* for recognition, Dr. Godman infers that the nestlings of *"D. chionoptera"* are white and that those of *D. exulans* are gray.[2] The adults being indistinguishable, such a condition would prove only that a dichromatism exists in the young, as in *Diomedea irrorata.*

Diomedea regia Buller is also considered to be a mere variation. The characters propounded for the supposed adult are fairly midway between those Mr. Salvin assigns to *D. exulans* and to *"D. chionoptera."*

The explanation of the diverse plumages of *Diomedea exulans,* I believe, is to be found in dichromatism and age variation, there being a dark phase and a light phase which coalesce in maturity, somewhat as in *Diomedea irrorata.*

Recently Mr. Gregory M. Mathews has revived *Diomedæa epomophora* Lesson, relegating to its synonymy *Diomedea*

[1] Monograph, p. 443.
[2] Cf. Mon. Petrels, pp. 310, 315, 319, 320, 325.

regia Buller, and dilating on the shape of the bill as a diagnostic character.[1] The extensive series now under review show that the individuals of Tubinarine species are subject to much variation in the form and size of the bill.

A later candidate for recognition is *Diomedea sanfordi* Murphy,[2] separated from *D. exulans* on the basis of variation in one specimen. Especial value is attached to the shape of the nasal tubes. This character, however, is a highly variable one in the *Diomedeæ*.

Diomedea nigripes *Audubon:* Black-footed Albatross

Diomedea albatrus *Pallas:* Short-tailed Albatross

Diomedea irrorata *Salvin:* Galapagos Albatross

Diomedea immutabilis *Rothschild:* Laysan Albatross

Thalassarche melanophris[3] (*Temminck*): Spectacled Albatross

Coues—*Diomedea melanophrys,* V, 181, 188; *Diomedea Gilliana,* V, 181, 188.
Salvin—*Diomedea melanophrys,* 441, 447.
Godman—*Diomedea melanophrys,* liv, 339, pl. 97; (?) *Diomedea platei,* liv, 346, pl. 98A.

As indicated in the Key to the Species, the basal width of the latericorn and that of the upper mandible divide the rounded-tailed albatrosses into two distinct groups, and these I have recognized as genera.[4] By this arrangement, *Thalassarche* Reichenbach becomes available as the name of the second genus of the family, *Thalassogeron* Ridgway sinking into a synonym.

I am of the opinion that *Diomedea platei* Reichenow is the young of *T. melanophris.* In the albatrosses much remains to

[1] Birds Austr., v. 2, p. 259.
[2] Bull. Amer. Mus. Nat. Hist., 1917, v. 37, pp. 861–864.
[3] "*Diomedea melanophris* 'Boies' is Temminck's original spelling in the Planches Col., Vol. v, 1838 (livraison 77, April, 1828), text to pl. 456, but it is '*melanophrys*' on p. 103 of Tabl. Méth. (1838) of the same work."—Dr. Richmond in letter.
[4] In this connection, see Coues, monograph, V, p. 174; Giglioli, Fauna Vertebr. Oceano, pp. 49, 56-59; Godman, Mon. Petrels, pp. lii, 354; Mathews, Birds Austr., v. 2, pp. 264-266.

be learned respecting the plumage and bill coloration during the progress towards maturity.

Thalassarche bulleri (*Rothschild*): BULLER'S ALBATROSS

SALVIN—*Diomedea bulleri*, 441, 448.
GODMAN—*Diomedea bulleri*, liv, 344, pl. 98.

In the four specimens of *T. bulleri* under examination, the culminicorn is separated basally from the latericorn by a membrane that is wider than the membrane in some specimens of *T. cauta*. At the frontal feathers, however, the membrane in *T. bulleri* is very narrow, at most being scarcely more than a line.

MEASUREMENTS (in millimeters)

No.	Locality	Sex	Wing	Tail	Culmen	Upper Mandible		Tarsus	Middle Toe and Claw
						Depth	Width		
24376[1]	Otago, N. Z..	♂	512	202	120	32	28.5	79	119
24377[1]	" " ..	♂	510	198	122	29	28	81	121
24378[1]	" " ..	♀	503	187	118	28.3	26	75	110
18170	New Zealand.	—	520	198	120	28	26.5	77.8	114

Thalassarche cauta (*Gould*): SHY ALBATROSS

COUES—*Diomedea cauta*, V, 183, 188.
SALVIN—*Thalassogeron cautus*, 449; *Thalassogeron salvini*, 449, 450; *Thalassogeron layardi*, 449, 450.
GODMAN—*Thalassogeron cautus*, liv, 348, pl. 99; *Thalassogeron salvini*, lv, 351, pl. 100; *Thalassogeron layardi*, liv, 353.

The characters attributed to *Thalassogeron salvini* Rothschild and *Thalassogeron layardi* Salvin appear to be merely variations occurring within the bounds of *T. cauta*.[2]

MEASUREMENTS (in millimeters)

No. (Carnegie Museum)	Locality	Sex	Wing	Tail	Culmen	Upper Mandible		Tarsus	Middle Toe and Claw
						Depth	Width		
24380	Otago, N. Z..	♂	580	226	132	32.5	32	86	133
24381	" " ..	♂	570	223	122	29	30	80	123
24379	" " ..	♀	570	228	125	32.6	32.6	84	124
24382	" " ..	♀	570	210	121	28	29	75	120
24383	" " ..	♀	550	205	129	30	27.6	82	132

[1] Carnegie Museum.
[2] Cf. Godman, Mon. Petrels, p. 353; Mathews, Birds Austr., v. 2, p. 293.

Thalassarche culminata (*Gould*): Culminated Albatross

Thalassarche chlororhynchos (*Gmelin*): Yellow-nosed Albatross

Coues—*Diomedea chlororhyncha,* V, 184, 188; *Diomedea olivaceirostris,* V, 186, 188.
Salvin—*Thalassogeron chlororhynchus,* 449, 451.
Godman—*Thalassogeron chlororhynchus,* liv, 357, pl. 102; *Thalassogeron carteri,* lv, 361, pl. 102A.

Thalassogeron carteri Rothschild is apparently based upon an immature stage of *T. chlororhynchos.*[1]

Phœbetria palpebrata (*J. R. Forster*): Sooty Albatross

PROCELLARIIDÆ: Fulmars, Prions, Shearwaters, and Petrels

Key to the Subfamilies

Tail not forked, chord of wing not under 5.75 in. (146 mm.), and tarsus not longer than middle toe and claw
  Lower mandible not hooked at end, or if hooked, inside of edge of upper mandible lamellate ..... **Fulmarinæ**
  Lower mandible hooked at end and inside of edge of upper mandible not lamellate ..... **Puffininæ**
Tail not forked and chord of wing under 5.75 in. (146 mm.); or tail forked; or tarsus decidedly longer than middle toe and claw
  Tarsus not twice length of femur, and basal joint of middle toe shorter than the next two joints..... **Thalassidrominæ**
  Tarsus fully twice length of femur, and basal joint of middle toe not shorter than the next two joints..... **Oceanitinæ**

FULMARINÆ: Fulmars and Prions

Key to the Species

Wing not under 16 in. (406 mm.)..... *Macronectes giganteus*
Wing under 16 in. (406 mm.)
  Inside of edge of upper mandible without lamellæ
    Nasal tubes separated from unguis by a space much less than half the length of the nasal tubes..... *Fulmarus glacialis*
    Nasal tubes separated from unguis by a space much more than half the length of the nasal tubes
      Bill not depressed and lateral outline not convex from base to unguis
        Head extensively white ..... *Priocella antarctica*
        Head dark ..... *Thalassoica antarctica*
      Bill depressed, except terminally, and lateral outline convex from base to unguis..... *Petrella capensis*
  Inside of edge of upper mandible with lamellæ, at least basally
    Tail slightly rounded, white at tip..... *Halobæna cærulea*
    Tail more or less wedge-shaped, dark at tip..... *Pachyptila vittata*

[1] Cf. Godman, Mon. Petrels, pp. 361, 362; Mathews, Birds Austr., v. 2, pp. 287, 288; Salvadori, Ibis, 1914, p. 504.

Macronectes giganteus (*Gmelin*): Giant Fulmar

Fulmarus glacialis (*Linnæus*): Fulmar

Priocella antarctica (*Stephens*): Slender-billed Fulmar

Thalassoica antarctica (*Gmelin*): Antarctic Fulmar

Coues—*Thalassoica antarctica,* III, 31, V, 192.
Salvin—*Thalassœca antarctica,* 392.
Godman—*Thalassœca antarctica,* xliii, 161, pl. 42.

Petrella capensis (*Linnæus*): Cape Petrel; Pintado Petrel

Halobæna cærulea (*Gmelin*): Blue Petrel

Coues—*Halobæna cærulea,* IV, 163, 171.
Salvin—*Halobæna cærulea,* 431.
Godman—*Halobæna cærulea,* I, 281, pl. 81.

The description fails to show that *Halobaena murphyi* Brooks[1] signifies more than a variation in the size and form of the bill in *Halobœna cœrulea.*

Pachyptila vittata (*Gmelin*): Prion

Coues—*Æstrelata desolata,* IV, 155, 171, in part; *Pseudoprion Banksii,* IV, 166, 172; *Pseudoprion turtur,* IV, 166, 172; *Pseudoprion ariel,* IV, 166, 172; *Pseudoprion brevirostris,* IV, 167; *Prion vittatus,* IV, 169, 172.
Salvin—*Prion vittatus,* 432; *Prion banksi,* 432, 434; *Prion desolatus,* 432, 434; *Prion ariel,* 432, 436.
Godman—*Prion vittatus,* li, 285, pl. 82; *Prion banksi,* li, 289, pl. 83; *Prion desolatus,* li, 293, pl. 84; *Prion brevirostris,* li, 297, pl. 85.

I have searched the literature in vain for a description of constant characters separating *"P. banksi," "P. desolata,"* and *"P. brevirostris"* from *P. vittata.* So far as the evidence shows, the variations upon which these supposed species rest are inconstant and therefore are not of specific significance; as absence of intergradation, not degree of variation, gives specific value to characters. The series before me is a meager one, but it strengthens the conviction that the variations are all within the limits of a single species. Ample series from

[1]Bull. Mus. Comp. Zool., 1917, v. 61, p. 146.

breeding stations alone will determine the precise nature of the variations.

In one specimen the first primary of one wing is longer than the second primary, but in twelve other specimens the first primary (fully grown) is equal to or shorter than the second.

Mr. T. Iredale has apparently shown that *Prion* Lacépède is indeterminable, and in consequence has revived *Pachyptila* Illiger,[1] which I have used in the present connection.

MEASUREMENTS (in millimeters)

No.	Locality	Sex	Wing	Tail	Culmen	Upper Mandible		Tarsus	Middle Toe and Claw
						Depth	Width		
24355 [2]	Otago, N. Z.	♂	200	105	35.5	14.2	21.6	32.8	43.9
151110 [3]	Chatham Is.	♂	216	103	35.9	14.5	20.1	33.2	41.6
17913	Otago, N. Z.	♂	...	89	35	12	15.7	35	41.4
124679 [3]	Hen and Chickens Is., N. Z.	♂	191	94	27.2	10.7	13.1	29	36
24356 [2]	Cape Farewell, N. Z.	♂	184	87	27	10.9	13.8	31.3	37.2
24357 [2]	" " "	♂	185	90	23.3	8.1	12	30	36.5
24358 [2]	Well, West Coast, N. Z.	♂	175	88	22.4	8	10.9	27.8	36.3
124678 [3]	Otago, N. Z.	♂	190	97	22.6	8.9	11.5	32.4	42.5
208736 [3]	Montevideo, Uruguay	♂	179	84	26.5	8.2	11	34.6	38
210723 [3]	" "	♂	188	84	27	8	10.5	34.6	42
68926 [3]	Kerguelen I.	♂	189	88	25.4	10.2	12.8	32	38
24354 [2]	Pitt I., Chatham Is.	♀	205	103	34.7	14.2	21.5	34	40.5
151111 [3]	Chatham Is.	♀	181	88	22	8	11	29.5	35.2
24359 [2]	Nelson, N. Z.	♀	169	86	23.3	7.8	9.5	29	37.1
124680 [3]	Hen and Chickens Is., N. Z.	—	184	85	27.9	10	12.5	31	34.9
159485 [3]	South Africa	—	...	87.5	25.7	9	12	29.8	35

PUFFININÆ: Shearwaters and Petrels

Key to the Species

Nostrils separated by a thin partition

Hind claw very large; plumage white ..... *Pagodroma nivea*

Hind claw small; plumage of upper parts not white

Breast and abdomen dark; tail more than half as long as wing

Greater wing-coverts grayish brown, forming a distinct bar ..... *Bulweria bulweri*

Greater wing-coverts sooty brown, not forming a distinct bar ..... *B. macgillivrayi*

Breast and abdomen white

Upper tail-coverts not white

Jugulum white, sometimes partially obscured by gray

Lower tail-coverts white

Under wing-coverts inwardly more or less white

Wing under 10 in. (254 mm.)

Axillaries black ..... *Pterodroma axillaris*

[1] Austral Avian Record, v. 2, pp. 25–27.

[2] Carnegie Museum.

[3] U. S. National Museum.

Axillaries white
Pileum and cervix extensively dark gray, blackish brown, or black, contrasting with the gray of the back
Under wing-coverts extensively dark-colored; no white on exposed inner webs of primaries.. ..... *P. hypoleuca*
Under wing-coverts extensively white; inner webs of primaries more or less white
Sides of jugulum gray..*P. P. leucoptera, longirostris*
Sides of jugulum black..*P. brevipes* (light phase)
Pileum, cervix, and back light gray, darkening with wear
Inner web of first primary with little or no white; inner margin of wing with a very broad dark band .....*P. nigripennis*
Inner webs of primaries conspicuously white..*P. cooki*
Wing not under 10 in. (254 mm.)
First primary extensively white on inner web; dark color of tail forming definite tips to outer feathers..*P. externa*
First primary with little or no white on inner web
White cervical collar, clouded with gray; dark color of tail not forming definite tips to outer feathers .....*P. cervicalis*
No white cervical collar.....*P. phæopygia*
Under wing-coverts dark, with or without white margins
Cervix and back slaty gray.....*P. mollis* (light phase)
Cervix and back light ashy gray.....*P. lessoni*
Lower tail-coverts dark, at least at tips of longer ones; inner webs of primaries extensively white..*P. neglecta* (light phase)
Jugulum decidedly dark-colored; cervix and back brown or black
Inner webs of primaries not white
Lower tail-coverts brown, or chiefly so.....*P. incerta*
Lower tail-coverts white, or chiefly so
Throat uniformly dark-colored, or more or less mottled with white
Culmen not under 1.2 in. (30 mm.).....*P. rostrata*
Culmen under 1.2 in. (30 mm.).....*P. parvirostris*
Throat white .....*P. magentæ*
Inner webs of primaries largely white..... .....*P. neglecta* (intermediate phase)
Upper tail-coverts white.....*P. hasitata*
Breast and abdomen dark; tail less than half as long as wing
Upper tail-coverts white.....*P. caribbæa*
Upper tail-coverts not white
Bill wide at gape
Inner webs of primaries not white
Cervix and back sooty brown
Culmen not under 1.2 in. (30 mm.).....*P. macroptera*
Culmen under 1.2 in. (30 mm.).....*P. aterrima*
Cervix and back slaty gray.....*P. mollis* (dark phase)
Cervix black, back ashy gray.....*P. brevipes* (dark phase)
Inner webs of primaries more or less white
Lower tail-coverts dark
Back and scapulars dark brown...*P. neglecta* (dark phase)
Back and scapulars "slate-grey with dark edgings to the feathers".....*P. solandri*
Lower tail-coverts chiefly white; back gray or slate-gray, with or without paler edgings to the feathers..... .....*P. inexpectata*
Bill much compressed; general aspect of plumage slaty gray; no white on primaries.....*P. brevirostris*

Nostrils separated by a thick partition

Nasal tubes not bevelled; nostrils only partially visible from above
Back, breast, and abdomen dark
Chin white.....*Procellaria æquinoctialis*
Chin dark.....*P. parkinsoni*
Back gray; breast and abdomen white.....*Priofinus cinereus*
Nasal tubes bevelled anteriorly; both nostrils visible from above
Tail not decidedly wedge-shaped
Lower parts white, or chiefly so
Wing not under 11 in. (279 mm.)
Pileum dark brown .....*Puffinus gravis*
Pileum gray
Lower tail-coverts wholly, or almost entirely white.....
.....*P. kuhli*
Lower tail-coverts largely dark-colored.....
.....*P. creatopus* (light phase)
Wing under 11 in. (279 mm.)
Lower tail-coverts largely dark-colored
Upper parts and dark color of lower tail-coverts brown; wing not under 8.8 in. (223 mm.).....
.....*P. puffinus* (brown-backed phase)
Upper parts and dark color of lower tail-coverts dark brown or black
Upper parts dark brown; axillaries narrowly and evenly tipped with white; wing not under 8.8 in. (223 mm.)
.....*P. opisthomelas*
Upper parts black; axillaries not narrowly and evenly tipped with white.....*P. auricularis*
Upper parts dark brown; wing under 8.8 in. (223 mm.); tail decidedly more than twice the length of exposed culmen.....*P. obscurus* (brownish-backed phase)
Lower tail-coverts wholly, or almost entirely white
Upper parts sooty black or blackish brown
Fore-neck not invaded by dark color of sides of neck; axillaries white, subterminally dark gray or sooty black; wing not under 8.8 in. (223 mm.).....
.....*P. puffinus* (black-backed phase)
Fore-neck more or less invaded by dark color of sides of neck; axillaries brown..*P. gavia* (brownish-backed phase)
Upper parts bluish black or plumbeous
Tail less, or but little more, than twice the length of exposed culmen.....*P. gavia* (bluish-backed phase)
Tail decidedly more than twice the length of exposed culmen; wing under 8.8 in. (223 mm.).....
.....*P. obscurus* (bluish-backed phase)
Lower parts white obscured by gray....*P. creatopus* (dark phase)
Lower parts white obscured by brown.....
.....*P. puffinus* (extreme brown phase)
Lower parts dark
Latericorn light-colored.....*P. carneipes*
Latericorn not light-colored
Breast and abdomen dark gray
Exposed culmen over 1.4 in. (36 mm.).....*P. griseus*
Exposed culmen not over 1.4 in. (36 mm.); bill at base relatively, sometimes actually, wider than in *P. griseus*
.....*P. tenuirostris*
Breast, abdomen, and under wing-coverts dark brown...
.....*P. nativitatis*

Tail decidedly wedge-shaped
Breast and abdomen dark.....*P. chlororhynchus* (dark phase)
Breast and abdomen white
Lower tail-coverts dark .....*P. chlororhynchus* (light phase)
Lower tail-coverts white
Inner webs of primaries extensively white.....*P. bulleri*
Inner webs of primaries not extensively white....*P. leucomelas*

Pagodroma nivea (*G. Forster*): Snowy Petrel

Coues—*Pagodroma nivea,* IV, 160, 171.
Salvin—*Pagodroma nivea,* 419.
Godman—*Pagodroma nivea,* xlviii, 254, pl. 73.

Procellaria nivea George Forster, *Voyage round the World,* 1777, Vol. I, pp. 96, 98, antedates *Procellaria nivea* Gmelin; cf. Mr. Gregory M. Mathew's *Birds of Australia,* Vol. II, p. 174.

Bulweria bulweri *(Jardine & Selby):* Bulwer's Petrel

Coues—*Æstrelata Bulweri,* IV, 158, 171.
Salvin—*Bulweria bulweri,* 420.
Godman—*Bulweria bulweri,* xlviii, 257, pl. 74.

Messrs. Mathews and Iredale state that they "separate the Pacific-breeding Bulwer's Petrel on account of its stronger bill."[1] It will be noticed that no such superiority in size is manifested in the subjoined measurements.

[1] Ibis, 1915, p. 607

MEASUREMENTS (in millimeters)

No.	Locality	Sex	Wing	Tail	Culmen	Upper Mandible		Tarsus	Middle Toe and Claw
						Depth	Width		
23422 [1]	Tenerife I., Canary Is.....	♂	204	113	22.9	7.4	9.5	28	30.5
23424 [1]	" "	♂	201	113	22	7.9	9.1	26.1	29.8
23425 [1]	" "	♂	204	114	21.1	7.4	9.3	26	29
23428 [1]	Santa Ursula, Tenerife I., Canary Is.....	♂	207	112	23	8	9.7	26.1	31.5
23433 [1]	Tenerife I., Canary Is.....	♂	210	114	22.8	8	9.5	26.1	30.6
189409 [2]	Necker I., Hawaiian Arch.	♂	201	113	21.7	8	10.5	27.8	29.8
189411 [2]	" " "	♂	193	107	22.5	7.5	10	24	27.6
189412 [2]	" " "	♂	198	109	22.8	7.5	9.9	26.3	30.9
189413 [2]	" " "	♂	202	114	22.3	7.4	10.3	26.6	30.8
5653 [3]	Bird I., Hawaiian Arch....	♂	190	111	21.5	7.5	10.4	26.1	30.6
5654 [3]	" " "	♂	199	121	22.8	7.2	9.4	26.8	30
5655 [3]	" " "	♂	200	110	22	7.8	10.5	27	31.2
5657 [3]	Necker I., Hawaiian Arch.	♂	202	117	21	7.6	10.5	24.9	29.4
5658 [3]	" " "	♂	199	108	21.3	8	10.2	26.7	28.8
5659 [3]	" " "	♂	199	115	21.5	7.8	9.8	26.3	29
23423 [1]	Tenerife I., Canary Is.....	♀	207	114	23	7.9	10	27.3	30
23426 [1]	Santa Ursula, Tenerife I., Canary Is.....	♀	202	110	22.4	8	9.7	25.9	29.9
23427 [1]	Santa Ursula, Tenerife I., Canary Is.....	♀	210	114	23.4	7.9	10	26	31.2
23429 [1]	Santa Ursula, Tenerife I., Canary Is.....	♀	202	107	22.5	8	10	28.2	31
23430 [1]	Santa Ursula, Tenerife I., Canary Is.....	♀	201	109	22.3	7.8	9.7	27.2	30.4
23431 [1]	Santa Ursula, Tenerife I., Canary Is.....	♀	202	109	22.2	7.9	10.6	25.6	28.7
23432 [1]	Santa Ursula, Tenerife I., Canary Is.....	♀	207	114	22.4	8	9.6	26.4	30.8
189407 [2]	Necker I., Hawaiian Arch.	♀	200	117	22.4	7.1	10	25.9	28.4
189408 [2]	" " "	♀	203	112	21	7.7	10	26	29.8
189410 [2]	" " "	♀	204	117	22	7.4	9.6	25.5	29.5
5656 [3]	Bird I., Hawaiian Arch....	♀	196	111	21.5	7.5	9.9	26.1	27.8

Bulweria macgillivrayi (*Gray*): MACGILLIVRAY'S PETREL

COUES—*Æstrelata Macgillivrayi*, IV, 159, 171.
SALVIN—*Bulweria macgillivrayi*, 420, 421.
GODMAN—*Bulweria macgillivrayi*, xlviii, 260, pl. 75.

Whether the variations existing in this supposed species are constant or not, is still an open question. So far as I have ascertained, a second specimen is yet to be taken.

[1] Carnegie Mus.
[2] U. S. Nat. Mus.
[3] Stanford Univ.

Pterodroma axillaris (*Salvin*): CHATHAM ISLANDS' PETREL

SALVIN—*Œstrelata axillaris*, 399, 418, pl. 7.
GODMAN—*Œstrelata axillaris*, xlvi, 252, pl. 72.

Mr. Gregory M. Mathews has apparently demonstrated that *Pterodroma* Bonaparte has line priority over *Æstrelata* Bonaparte.[1]

MEASUREMENTS (in millimeters)

No.	Locality	Sex	Wing	Tail	Culmen	Upper Mandible		Tarsus	Middle Toe and Claw
						Depth	Width		
24346 [2]	Chatham Is.....	♂	215	93	24	8	10.3	30	37.1
24347 [2]	" "	♀	214	93	24	8.5	10.5	30	35.8
208604 [3]	" "	—	220	94	23.4	8.2	11	28.3	37.9
208605 [3]	" "	—	216	92	23.4	8	10.5	30.5	38

Pterodroma hypoleuca (*Salvin*): WHITE-BREASTED PETREL

SALVIN—*Œstrelata hypoleuca*, 398, 409.
GODMAN—*Œstrelata hypoleuca*, xlvi, 212, pl. 58.

In some examples of *P. hypoleuca* the tail is more than half as long as the wing (see subjoined measurements), and is graduated for more than one third of its length. Evidently, the tail characters can not be entirely depended upon to distinguish *Bulweria* from *Pterodroma*.

MEASUREMENTS (in millimeters)

No.	Locality	Sex	Wing	Tail	Culmen	Upper Mandible		Tarsus	Middle Toe and Claw
						Depth	Width		
189403 [4]	Laysan I., Haw. Arch.	♂	215	114	25.8	8.9	10.9	28.3	35.4
23470 [5]	" " "	♂	230	115	25.7	8.9	10.7	29.5	37
9270 [6]	" " "	♂	223	114	25.9	9	11	26.8	34.9
9274 [6]	" " "	♂	231	116	25	9.8	11.6	29	37.6
9272 [6]	" " "	♀	225	105	25.2	8	10.7	28	36
9273 [6]	" " "	♀	224	113	26.3	9.2	11.3	29	36.5
5663 [7]	" " "	♀	226	114	25.6	8.6	10.5	28.8	36
5664 [7]	" " "	♀	233	117	25.8	8.4	11.5	28.4	35.9

[1] Birds Austr., v. 2, pp. 131, 132; cf. B. O. U. List, 2d ed., p. 398.
[2] Carnegie Mus.
[3] U. S. Nat. Mus.
[4] U. S. Nat. Mus.
[5] Mus. Vertebr. Zool., Univ. Calif.
[6] Coll. J. E. Thayer.
[7] Stanford Univ.

Pterodroma leucoptera (*Gould*): White-winged Petrel

Salvin—*Œstrelata leucoptera*, 399, 416.
Godman—*Œstrelata leucoptera*, xlv, 243, pl. 69.

I am unable to determine the status of *Æstrelata longirostris* Stejneger and *Procellaria leucoptera* Gould without comparing the type of the former with a series of the latter from its type locality, Port Stephens, New South Wales, Australia.

The specimens of *P. P. axillaris, hypoleuca, longirostris* (provisionally determined), *brevipes, nigripennis,* and *cooki* at my disposition show no intergradation.

Pterodroma longirostris (*Stejneger*): Stejneger's Petrel

Pterodroma brevipes (*Peale*): Short-footed Petrel

Pterodroma nigripennis (*Rothschild*): Kermadec Petrel

Salvin—*Œstrelata nigripennis*, 398, 409.
Godman—*Œstrelata nigripennis*, xlvi, 214, pl. 59.

In No. 151108 U. S. Nat. Mus. light gray vermiculations extend across the jugulum, forming a faint band about half an inch in width. Another specimen has a similar but narrower band, and another still, indications of one.

MEASUREMENTS (in millimeters)

No.	Locality	Sex	Wing	Tail	Culmen	Upper Mandible		Tarsus	Middle Toe and Claw
						Depth	Width		
24325 [1]	Kermadec Is....	♂	227	100	24.6	8.9	10.5	29	36.7
151108 [2]	" "	♂	231	99.5	24	8.3	11	29.2	37.3
24324 [1]	————	♀	227	101	24.1	8.3	10	29	36.3
24326 [1]	Kermadec Is....	♀	235	102	24.3	8.7	11	28.5	35.3
174640 [2]	" "	—	227	95	24.9	9	11.1	29.5	34.2

Pterodroma cooki (*Gray*): Cook's Petrel

Pterodroma externa (*Salvin*): Juan Fernandez Petrel

[1] Carnegie Mus.
[2] U. S. Nat. Mus.

Pterodroma cervicalis (*Salvin*): Sunday Island Petrel

Salvin—*Œstrelata cervicalis*, 398, 411, pl. 6.
Godman—*Œstrelata cervicalis*, xliv, 223, pl. 63.

MEASUREMENTS (in millimeters)

No.	Locality	Sex	Wing	Tail	Culmen	Upper Mandible		Tarsus	Middle Toe and Claw
						Depth	Width		
24330 [1]	Kermadec Is....	♂	318	137	—	—	18.5	37.4	51
24327 [1]	" "	♀	320	127	37	13	16.6	40.5	52
24329 [1]	" "	♀ [3]	313	134	36	12.4	16.8	37.8	48.9
151107 [2]	" "	—	308	135	35	13.2	18	37.4	51.2
174639 [2]	" "	—	321	138	36.1	13.5	17	39.3	51.8

Pterodroma phæopygia (*Salvin*): Dark-rumped Petrel

Pterodroma mollis (*Gould*): Downy Petrel

Coues—*Æstrelata mollis*, IV, 150, 170.
Salvin—*Œstrelata mollis*, 398, 406.
Godman—*Œstrelata mollis*, xlvi, 197, pl. 54; *Œstrelata fœ*, xlvi, 201.

I do not concur with Dr. Godman in his acceptance of *Œstrelata fœ* Salvadori; for it has not been established that the gray band across the fore-neck is a stable character in the light phase of *Pterodroma mollis*. In *Pterodroma nigripennis*, *Pterodroma phæopygia*, and *Puffinus auricularis* the jugular band is certainly inconstant.

Pterodroma lessoni (*Garnot*): Lesson's Petrel

Coues—*Adamastor sericeus*, II, 122, 142; *Æstrelata Lessoni*, IV, 142, 170; *Priof[inus]sericeus*, V, 192.
Salvin—*Œstrelata lessoni*, 398, 401.
Godman—*Œstrelata lessoni*, xliv, 181, pl. 48.

Pterodroma incerta (*Schlegel*): Schlegel's Petrel

Coues—*Æstrelata incerta*, IV, 147, 170.
Salvin—*Œstrelata incerta*, 398, 405.
Godman—*Œstrelata incerta*, xlvi, 195, pl. 53.

[1] Carnegie Mus.
[2] U. S. Nat. Mus.
[3] Juv.

Dr. Godman remarks in his monograph that "it is by no means unlikely that *Œ. incerta* may be only the dark phase of *Œ. lessoni.*"[1]

With the light of the manuscript description of *Procellaria sandaliata* Solander, Mr. T. Iredale identifies *Procellaria incerta* Schlegel as a synonym of *Procellaria alba* Gmelin.[2] However, a specimen (No. 24332 Carnegie Mus.) of an intermediate phase of *Pterodroma neglecta* (Schlegel) from the Kermadec Islands agrees well with Latham's description of his White-breasted Petrel, upon which *Procellaria alba* Gmelin was based. In view of this discrepancy, I am of the opinion that Dr. Schlegel's type specimens (extant in the Leyden Museum) and original descriptions of *P. incerta* and *P. neglecta* are a surer means of determining the names of the two birds in question than the eighteenth century descriptions; in consequence, *Pterodroma incerta* (Schlegel) and *Pterodroma neglecta* (Schlegel) are retained.

Pterodroma neglecta (*Schlegel*): Neglected Petrel

Pterodroma rostrata (*Peale*): Thick-billed Petrel

Coues—*Æstrelata rostrata*, IV, 144, 170.
Salvin—*Œstrelata rostrata*, 398, 404.
Godman—*Œstrelata rostrata*, xlvi, 190, pl. 51.

Pterodroma parvirostris (*Peale*): Small-billed Petrel

Pterodroma magentæ (*Giglioli & Salvadori*): Magenta Petrel

Salvin—*Œstrelata magentæ*, 407.
Godman—*Œstrelata magentæ*, xlvi, 203, pl. 55.

The status of *Pterodroma rostrata, P. parvirostris,* and *P. magentæ* can be satisfactorily determined only when a series of specimens showing the alleged specific characters has been collected and studied.

[1] Mon. Petrels, p. 196.
[2] Ibis, 1913, p. 132; cf. Mathews and Iredale, Ibis, 1913, p. 231, Mathews, Birds Austr., v. 2, pp. 149–151.

It is yet to be demonstrated that *Æstrelata oliveri* Mathews & Iredale,[1] based upon one specimen, is distinct from *P. parvirostris*. The assumed specific characters belong to a class that often proves to be inconstant when a series of specimens is examined.

Pterodroma hasitata (*Kuhl*): Capped Petrel

Coues—*Æstrelata hæsitata*, IV, 139, 170.
Salvin—*Œstrelata hæsitata*, 398, 402.
Godman—*Œstrelata hæsitata*, xliv, 184, pl. 49.

Pterodroma caribbæa *Carte*: Caribbean Petrel

Coues—*A*[*Estrelata*] *carribæi*, IV, 171, 159.
Salvin—*Œstrelata jamaicensis*, 398, 403.
Godman—*Œstrelata jamaicensis*, xlvii, 187, pl. 50.

As ornithologists have examined but few specimens of *Pterodroma hasitata* and *Pterodroma caribbæa*, it remains to be absolutely determined whether the latter is, or is not, a dark phase of the former. Thorough search offshore in West Indian waters would likely be rewarded by a comprehensive series of these birds, for it seems improbable that all their breeding places could have been invaded by imported enemies.

Dr. Godman has clearly set forth the fact that under the rules of nomenclature *Procellaria jamaicensis* Bancroft is a *nomen nudum*.[2]

Recently, Mr. G. K. Noble has revived *Procellaria diabolica* Lafresnaye[3] on the strength of certain discrepancies in size, in the shape of the nasal tubes, and in the dark cap occurring in nine specimens, which of late have been referred to *Pterodroma hasitata* (Kuhl). The meager series at Mr. Noble's command does not justify this revival. Extensive series show that the range of variation is wide in Tubinarine species. For example, in a large series of *Pterodroma phæopygia* from the

[1] Austral Avian Record, 1914, v. 2, p. 113.
[2] Mon. Petrels, p. 188.
[3] Bull. Mus. Comp. Zool., 1916, v. 60, pp. 370–374.

Galapagos Islands variations occur similar to those described by Mr. Noble, and also greater variations.

I apprehend that *Æstrelata cahow* Nichols & Mowbray[1] will prove to be a variation of *Pterodroma hasitata.*

Pterodroma macroptera (*A. Smith*): Long-winged Petrel

Coues—*Æstrelata macroptera,* IV, 155, 171; *Æstrelata fuliginosa,* IV, 157, 171.
Salvin—*Œstrelata macroptera,* 398, 399.
Godman—*Œstrelata macroptera,* xlvii, 176, pl. 46.

Pterodroma aterrima *Bonaparte:* Mascarene Petrel

Coues—*Æstrelata aterrima,* IV, 158, 171.
Salvin—*Œstrelata aterrima,* 398, 401.
Godman—*Œstrelata aterrima,* xlviii, 179, pl. 47.

None of the three monographers has tested by a series of specimens the characters assigned to *P. aterrima.*

Pterodroma solandri (*Gould*): Solander's Petrel

Coues—*Æstrelata Solandri,* IV, 148, 170.
Salvin—*Œstrelata solandri,* 398, 410.
Godman—*Œstrelata solandri,* xlvii, 219, pl. 61.

Gould's type (preserved in the British Museum) and original description seem to me to be a more certain means of determining the specific name of this species than the Latham and Gmelin descriptions cited by Mr. Gregory M. Mathews.[2] Hence, *Pterodroma solandri* (Gould) is retained and *Pterodroma melanopus* (Gmelin) rejected.

Pterodroma inexpectata (*J. R. Forster*): Mottled Petrel

Pterodroma brevirostris (*Lesson*): Short-billed Petrel

Coues—*Æstrelata grisea,* IV, 148, 170; [*P. brevirostris,* IV, 156].
Salvin—*Œstrelata brevirostris,* 398, 409.
Godman—*Œstrelata brevirostris,* xlvii, 216, pl. 60.

[1]Auk, 1916, v. 33, p. 194.
[2]Cf. Birds Austr., v. 2, pp. 142–147.

Procellaria æquinoctialis *Linnæus:* White-chinned Black Petrel

Coues—*Majaqueus aequinoctialis,* II, 118, 142; *Majaqueus conspicillatus,* II, 118, 142.
Salvin—*Majaqueus æquinoctialis,* 395.
Godman—*Majaqueus æquinoctialis,* xliii, 169, pl. 44.

Procellaria parkinsoni *Gray:* Parkinson's Petrel

Priofinus cinereus (*Gmelin*): Black-tailed Shearwater

Puffinus gravis (*O'Reilly*): Great Shearwater

Coues—*Puffinus major,* II, 132, 144.
Salvin—*Puffinus gravis,* 369, 373.
Godman—*Puffinus gravis,* xli, 90, pl. 25.

Puffinus kuhli (*Boie*): Kuhl's Shearwater

Coues—*Adamastor gelidus,* II, 121, 142, V, 192, in part; *Puffinus Kuhlii,* II, 128, 143; *Priof*[*inus*] *gelidus,* V, 192 in part.
Salvin—*Puffinus kuhli,* 369, 375.
Godman—*Puffinus kuhli,* xli, 94, pl. 26; *Puffinus edwardsi,* vi, xli, 99.

Of two specimens of this species, one has the anterior edge of the tarsus sharp for nearly its entire length, while the other has scarcely any sharp anterior edge. In a specimen of *Puffinus creatopus* (No. 16238 C. A. S.) the tarsus is thicker than in either of the two *P. kuhli,* and is wholly without a sharp anterior edge. In another *P. creatopus* (No. 9394 C. A. S.) the tarsus is more compressed, and has a very sharp anterior edge. Clearly, the form of the tarsus is not a reliable character in these two species.[1]

Puffinus creatopus *Coues:* Cooper's Shearwater; Pink-footed Shearwater

Puffinus puffinus (*Brünnich*): Manx Shearwater

Coues—*Puffinus anglorum,* II, 134, 144; *Puffinus Yelcuanus,* II, 137, 144.
Salvin—*Puffinus anglorum,* 369, 377; *Puffinus yelkouanus,* 369, 379.
Godman—*Puffinus anglorum,* xli, 104, pl. 28; *Puffinus yelkouanus,* xli, 107, pl. 29.

[1] Cf. Mathews and Iredale, Ibis, 1915, pp. 584, 592.

In the second edition of the *B. O. U. List, Puffinus yelkouan* (Acerbi) is treated as a subspecies of *Puffinus puffinus,* and is therefore included in the above synonymy. The variations distinguishing the two phases appear to be dichromatic as well as geographic.

So close is the resemblance of the light phase of *P. opisthomelas* to *"P. yelkouan"* that I am unable to define fully their distinctive characters without a more adequate series of *"P. yelkouan"* for comparison.

MEASUREMENTS (in millimeters)

No.	Locality	Sex	Wing	Tail	Culmen	Upper Mandible		Tarsus	Middle Toe and Claw
						Depth	Width		
23418 [1]	Bigbury Bay, Devonshire, Eng.	♂	242	78	35.7	8.5	14	45	50
23420 [1]	South Wales.	♂	233	77	34.5	8.3	14	43.3	49.2
23421 [1]	Old Head of Kinsale, co. Cork, Ireland.	♂	236	73	35.3	8	14.5	43.7	48
23419 [1]	Bigbury Bay, Devonshire, Eng.	♀	244	76	38.1	8.4	12.5	45	50
113660 [2]	New Brunswick, Can.	♀	237	79	36.1	8	12	44.1	51
74307 [2]	Bosporus.	♂	236	71	34.2	8.2	12.8	45	49.5
115493 [2]	S. Antioco, Sardinia.	♂	...	66 [3]	40.5	8.7	13.1	44.3	51.2
115492 [2]	Nice.	♀	240	68	37	7.8	13.2	44	49

Puffinus opisthomelas *Coues:* BLACK-VENTED SHEARWATER

Puffinus auricularis *C. H. Townsend:* TOWNSEND'S SHEARWATER

Puffinus gavia *(J. R. Forster):* FORSTER'S SHEARWATER

COUES—*Æstrelata gavia,* IV, 154, 171.
SALVIN—*Puffinus gavia,* 369, 381.
GODMAN—*Puffinus gavia,* xlii, 120, pl. 32.

It is maintained by Mr. Gregory M. Mathews that the words *"supra coerulescenti-nigra"* in the original description of *Procellaria gavia* J. R. Forster[4] prove that the description does not relate to the shearwater we are considering, but to the small bluish-backed one frequenting New Zealand seas,

[1] Carnegie Mus.
[2] U. S. Nat. Mus.
[3] Rectrices worn.
[4] Descr. Anim., p. 148.

commonly known by the name of *"Puffinus assimilis."*[1] Mr. Mathews also maintains that the present species was nameless, and he has christened it *Puffinus reinholdi*[2] and *Reinholdia reinholdi.*[3] However, the length of the bill in Forster's description (*"in fronte 1½" unc., "ad angulum faucis 2" unc.*) appears to be less typical of *"P. assimilis"* than of the present species. Moreover, in some specimens of the present species the sooty black of the upper parts has a bluish cast in certain lights. In fine, the evidence thus far presented against the specific name *gavia* is not deemed conclusive. The characters of *Reinholdia* occur in some examples of *Puffinus puffinus.* See table of measurements of that species.

The dark coloration of the lower parts of certain specimens of *P. gavia,* said by Dr. Godman to be peculiar to the female,[4] occurs in the male as well as in the female, and is perhaps dichromatic.

MEASUREMENTS (in millimeters)

No. (Carnegie Mus.)	Locality	Sex	Wing	Tail	Culmen	Upper Mandible		Tarsus	Middle Toe and Claw
						Depth	Width		
24305	Well, West Coast, N.Z.	♂	222	65	39.5	7.7	12.9	41.9	50
24306	Wanganui Heads, N.Z.	♂	216	66	36.2	7.3	12.5	40.3	48.2
24315	Nelson, N. Z..	♂	217	67	35	7	12.5	42	46.8
24314	" "	♀	216	66	33	7.5	13.5	42.6	51

Note.—Since the above was written, *Cinathisma cyaneoleuca* Hull has been described.[5] According to Mr. Gregory M. Mathews it " is undoubtedly the same as *Reinholdia reinholdi byroni* Mathews."[6] This being the case, Mr. Mathews's contention respecting the identity of *Procellaria gavia* J. R. Forster wholly breaks down, the species having a brown as well as a bluish phase.

Puffinus obscurus (*Gmelin*): Dusky Shearwater; Least Shearwater

[1] Birds Austr., v. 2, pp. 53, 54, 68, 69.
[2] Birds Austr., v. 2, pp. 74, 76.
[3] Austral Avian Record, v. 1, p. 107.
[4] Mon. Petrels, p. 123.
[5] Emu, 1916, v. 15, pp. 205, 211, pl. 32.
[6] Austral Avian Record, 1917, v. 3, p. 77.

Puffinus carneipes *Gould:* FLESH-FOOTED SHEARWATER

Puffinus griseus (*Gmelin*)*:* SOOTY SHEARWATER

Puffinus tenuirostris (*Temminck*)*:* SLENDER-BILLED SHEARWATER

Puffinus nativitatis *Streets:* CHRISTMAS ISLAND SHEARWATER

Puffinus chlororhynchus *Lesson:* WEDGE-TAILED SHEARWATER

Puffinus bulleri *Salvin:* BULLER'S SHEARWATER

Puffinus leucomelas (*Temminck*)*:* STREAKED SHEARWATER

COUES—*Puffinus leucomelas,* II, 130, 144.
SALVIN—*Puffinus leucomelas,* 369, 370.
GODMAN—*Puffinus leucomelas,* xl, 72, pl. 21.

THALASSIDROMINÆ: STORM PETRELS

Key to the Species

General color dark
- Tail wedge-shaped ..... *Halocyptena microsoma*
- Tail nearly even or slightly rounded ..... *Thalassidroma pelagica*
- Tail forked
  - Upper tail-coverts more or less white
    - Tail slightly forked; upper tail-coverts white ..... *Oceanodroma tethys*
    - Tail deeply forked; upper tail-coverts very broadly tipped with black ..... *O. macrodactyla*
    - Tail at least slightly forked; tips of upper tail-coverts black; lateral rectrices definitely white at base for nearly an inch, or more ..... *O. castro*
    - Tail decidedly forked; tips of upper tail-coverts more or less dark gray, becoming white with wear; lateral rectrices not definitely white at base for nearly an inch ..... *O. leucorhoa*
  - Upper tail-coverts not white
    - A pale area on under wing-coverts ..... *O. homochroa*
    - No pale area on under wing-coverts
      - Pileum and throat not sooty black
        - Wing under 6.7 in. (170 mm.) ..... *O. leucorhoa* (dark phase)
        - Wing not under 6.7 in. (170 mm.)
          - Upper tail-coverts with a drab patch ..... *O. tristrami*
          - Upper tail-coverts without a drab patch ..... *O. markhami*
      - Pileum and throat sooty black ..... *O. melania*

General color not dark; tail forked
- Bluish gray above and below ..... *O. furcata*
- White below, with dark jugular band ..... *O. hornbyi*

Halocyptena microsoma *Coues:* Least Petrel

Thalassidroma pelagica (*Linnæus*): Storm Petrel

Coues—*Procellaria pelagica,* I, 80, 90, V, 192; *Procellaria lugubris,* I, 80, 90, V, 192; *Procellaria melitensis,* I, 81, 90, V, 192.
Salvin—*Procellaria pelagica,* 343.
Godman—*Procellaria pelagica,* xxxv, 1, pl. 1.

Oceanodroma tethys (*Bonaparte*): Galapagos Petrel

Oceanodroma macrodactyla *W. Bryant:* Guadalupe Petrel

Oceanodroma castro (*Harcourt*): Harcourt's Petrel

Oceanodroma leucorhoa (*Vieillot*): Leach's Petrel

Oceanodroma homochroa (*Coues*): Ashy Petrel

Oceanodroma tristrami *Salvin:* Tristram's Petrel

Salvin—*Oceanodroma fuliginosa,* 347, 352; *Oceanodroma tristrami,* 347, 354.
Godman—*Occanodroma tristrami,* xxxvi, 20.

The drab patch of the posterior surface of the upper tail-coverts, corresponding somewhat to the white patch in *Oceanodroma macrodactyla,* appears to be a constant character, for it is present in each of the five specimens before me—three adults and two hornotines from the Leeward Islands, Hawaiian Archipelago. Like the types of *O. macrodactyla,* two of the adults and the hornotines have a cap of dark neutral gray investing most of the crown, the occiput, and the upper cervix, and contrasting with the deep neutral gray of the lower cervix and interscapulars. One of the hornotines (No. 5652 Stanford Univ.) exhibits the "mottled appearance" mentioned in the original description of the species, published in Mr. Salvin's monograph. *Cymochorea owstoni* Mathews & Iredale falls within the limits of variation in the Hawaiian specimens, the fifth one agreeing with the description[1] of this nominal species.

[1] Ibis, 1915, p. 581.

Dr. Walter K. Fisher has recorded a wing-measurement of 150 mm.,[1] taken from one of the hornotines mentioned above (No. 189406 U. S. Nat. Mus.). On lifting the under wing-coverts of this specimen, I find that the four outermost primaries are still in the sheath. Doubtless, the primaries were in a similar stage in the short-winged specimens reported by Prof. Homer R. Dill.[2] According to the original account, the "wing-feathers" of the lost type were "not quite fully grown."

MEASUREMENTS (in millimeters)

No.	Locality	Sex	Wing	Tail	Fork of Tail	Culmen	Tarsus	Middle Toe and Claw
23468[3]	Laysan I., Haw. Arch....	♂	182	100	39	17	27.9	29.4
23469[3]	" " "	♂	192	100	34	18.3	27.7	30
211224[4]	Near Midway I., Haw. Arch.....	♀	184	110	44	17.7	26.3	28

Oceanodroma markhami (*Salvin*): Markham's Petrel

Oceanodroma melania (*Bonaparte*): Black Petrel

Oceanodroma furcata (*Gmelin*): Fork-tailed Petrel

Oceanodroma hornbyi (*Gray*): Hornby's Petrel

OCEANITINÆ: Long-legged Storm Petrels

Key to the Species

Basal joint of middle toe at most only slightly flattened, and shorter than remainder of toe and claw
- Upper tail-coverts white
  - Breast and abdomen dark.....*Oceanites oceanicus*
  - Lower breast and abdomen white.....*O. gracilis*
  - Breast and sides white with dark streaks.....*Pealea lineata*
- Upper tail-coverts not white
  - No white on head.....*Garrodia nereis*
  - Forehead, lores, and superciliary stripe white..... ..... *Pelagodroma marina*

[1] Bull. U. S. Fish Com. for 1903, p. 27.
[2] Bull. No. 42 Biol. Surv., U. S. Dept. Agric., pp. 18, 19.
[3] Mus. Vertebr. Zool., Univ. Calif.
[4] U. S. Nat. Mus.

Basal joint of middle toe greatly flattened, and not shorter than remainder of toe and claw
Upper tail-coverts white
Tail nearly even
Jugulum sooty black; the middle of the breast and abdomen more or less sooty black; sides white.....
.....*Fregetta melanogaster*
Jugulum dark gray; breast and abdomen white.....
..... *F. grallaria*
Tail decidedly forked; lower parts white with a dark jugular band .....*F. albigularis*
Upper tail-coverts not white; lower parts dark.....*F. mœstissima*

Oceanites oceanicus (*Kuhl*): Wilson's Petrel

Oceanites gracilis (*Elliot*): Graceful Petrel

Pealea lineata (*Peale*): Peale's Petrel

Coues—*Oceanites lineata*, I, 83, 91.
Salvin—*Pealea lineata*, 364.
Godman—*Pealea lineata*, xxxvii, 57, pl. 16.

Garrodia nereis (*Gould*): Gray-backed Petrel

Coues—*Procellaria nereis*, I, 81, 90.
Salvin—*Garrodia nereis*, 361.
Godman—*Garrodia nereis*, xxxvii, 50, pl. 14.

Pelagodroma marina (*Latham*): White-faced Petrel

Fregetta melanogaster (*Gould*): Black-bellied Petrel

Coues—*Fregetta melanogastra*, I, 87, 91.
Salvin—*Cymodroma melanogaster*, 364.
Godman—*Cymodroma melanogaster*, xxxviii, 59, pl. 17.

In their monographs Mr. Salvin and Dr. Godman rank *Thalassidroma tropica* Gould as a synonym of *Thalassidroma melanogaster* Gould, ignoring the page priority of the former name. However, Dr. Godman states, on the authority of Dr. R. Bowdler Sharpe, that "the name of *C. tropica* carries a certain amount of doubt with it."[1] Obviously, *melanogaster* (a determined name) should not be superseded by *tropica* unless all reasonable doubt is removed from *tropica*.[2]

[1] Mon. Petrels, p. 61.
[2] Cf. Mathews, Birds Austr., v. 2, pp. 34, 35.

Fregetta grallaria (*Vieillot*): White-bellied Petrel

Fregetta albigularis (*Finsch*): White-throated Petrel

Coues—*Fregetta tropica*, I. 85, 91, in part.
Salvin—*Cymodroma albigularis*, 364, 367.
Godman—*Cymodroma albigularis*, xxxviii, 68, pl. 19.

Fregetta mœstissima *Salvin*: Samoan Petrel

Salvin—*Cymodroma mœstissima*, 364, 367.
Godman—*Cymodroma mœstissima*, xxxviii, 71, pl. 20.

PELECANOIDIDÆ: Diving Petrels

Key to the Species

Nasal tubes, jointly, shaped somewhat like a twin ellipse, and not very prominent ..... *Pelecanoides urinatrix*
Nasal tubes, jointly, heart-shaped and very prominent..... *P. garnoti*

Pelecanoides urinatrix (*Gmelin*): Diving Petrel

Coues—*Pelecanoides urinatrix*, V, 190; *Pelecanoides Berardii*, V, 190.
Salvin—*Pelecanoides urinatrix*, 437; *Pelecanoides exsul*, 437, 438.
Godman—*Pelecanoides urinatrix*, li, 299, pl. 86; *Pelecanoides exsul*, lii, 304, pl. 87.

The gray barring on the throat and jugulum of three Kerguelen Island specimens bears a strong resemblance to that in the gray-throated phase of *Puffinus opisthomelas*. A fourth Kerguelen specimen (68929 U. S. Nat. Mus.) has the gray chiefly restricted to the jugulum, in this respect nearly approaching the grayest specimen from New Zealand seas (No. 24361 Carnegie Mus.; Auckland Is.). Dr. Einar Lönnberg has suggested that the explanation of the white and gray phases (recognized in nomenclature as *P. urinatrix* and "*P. exsul*") is perhaps to be found in dichromatism.[1] The variation is certainly not sexual, and is apparently not due to age, for an Auckland Island specimen (No. 24362 Carnegie Mus.) going out of the natal down has the definitive feathers of the fore-neck immaculate white, while a New Zealand specimen (No. 24365 Carnegie Mus.), likewise going out of the natal down, has gray on the definitive feath-

[1] Contr. Fauna South Georgia, p. 74.

ers of the jugulum. As the specimens before me from New Zealand seas are not so conspicuously gray as the Kerguelen ones, it may be that geographic variation also enters as a factor, dichromatism being modified by geographic variation.

In the majority of the specimens I have examined, the first is the longest primary.

Pelecanoides georgica Murphy & Harper is not recognized, for the description fails to demonstrate the stability of the alleged specific characters.[1]

MEASUREMENTS (in millimeters)

No.	Locality	Phase	Sex	Chord of Wing	Tail	Culmen	Tarsus	Middle Toe and Claw
68927 [2]	Kerguelen I.....	Gray	♂	123	40	17	27	33
68928 [2]	"	"	♂	118	39	15	25	30
68931 [2]	"	"	♀	118	39	16	25	33
68929 [2]	"	"	—	116	38	17	25	31
24361 [3]	Auckland Is.....	Intermediate	♂	112	39	14.5	23	29
24360 [3]	Mangare I.....	"	♀	110	39	16	23	28.5
24364 [3]	Stephens I., N. Z...	"	♀	123	42	17	27.5	32.5
24363 [3]	" " ...	"	♂	135	45	17	27	34.5
151112 [2]	Chatham Is.....	"	♂	114	39	16	24	31
17914	Otago, South I., N. Z.	"	♂	114	39	16	25	29.5
124682 [2]	Near Dunedin, N. Z.	White	—	115	39	16	23	29.5

Pelecanoides garnoti (*Lesson*): Garnot's Diving Petrel

Coues—*Pelecanoides Garnoti,* V, 190.
Salvin—*Pelecanoides garnoti,* 437, 439.
Godman—*Pelecanoides garnoti,* lii, 307, pl. 88.

The accompanying tables of measurements manifest that the length of the wing, supposed by Mr. Salvin and Dr. Godman to be a diagnostic character, can not be implicitly relied upon to distinguish *P. garnoti* from *P. urinatrix.*

MEASUREMENTS (in millimeters)

No. U.S. Nat. Mus.	Locality	Sex	Chord of Wing	Tail	Culmen	Tarsus	Middle Toe and Claw
15464	Callao, Peru.....	♂	132	39	20.1	31	35.5
32106	Valparaiso.....	—	137	42	20	32	38
212020	San Gallan I., Peru.....	♂	127	37	20	33	37
212022	Independencia Bay, Peru.....	—	136	40	21	34	39
212023	Ballestas, North I., Peru.....	♀	126	39	19	32	35

[1] Cf. Bull. Amer. Mus. Nat. Hist., 1916, v. 35, p. 66.
[2] U. S. National Museum.
[3] Carnegie Museum.

Tabular Summary

DIOMEDEIDÆ ..... 1 species
- Diomedea *Linnæus* ..... 5 species
- Thalassarche *Reichenbach* ..... 5 "
- Phœbetria *Reichenbach* ..... 1 "

PROCELLARIIDÆ ..... 73 species

Fulmarinæ ..... 7 species
- Macronectes *Richmond* ..... 1 species
- Fulmarus *Stephens* ..... 1 "
- Priocella *Hombron & Jacquinot*.... 1 "
- Thalassoica *Reichenbach* ..... 1 "
- Petrella *Zimmermann* ..... 1 "
- Halobæna *Bonaparte* ..... 1 "
- Pachyptila *Illiger* ..... 1 "

Puffininæ ..... 45 species
- Pagodroma *Bonaparte* ..... 1 species
- Bulweria *Bonaparte* ..... 2 "
- Pterodroma *Bonaparte* ..... 24 "
- Procellaria *Linnæus* ..... 2 "
- Priofinus *Hombron & Jacquinot*.... 1 "
- Puffinus *Brisson* ..... 15 "

Thalassidrominæ ..... 12 species
- Halocyptena *Coues* ..... 1 species
- Thalassidroma *Vigors* ..... 1 "
- Oceanodroma *Reichenbach* ..... 10 "

Oceanitinæ ..... 9 species
- Oceanites *Keyserling & Blasius*..... 2 species
- Pealea *Ridgway* ..... 1 "
- Garrodia *Forbes* ..... 1 "
- Pelagodroma *Reichenbach* ..... 1 "
- Fregetta *Bonaparte* ..... 4 "

PELECANOIDIDÆ ..... 2 species
- Pelecanoides *Lacépède*..... 2 species

Total 86 species

VI

REMARKS ON THE SPECIES OF THE PACIFIC OCEAN ADJACENT TO NORTH AMERICA AND THE GALAPAGOS ISLANDS

Plates 5-17

Material.—This part of the paper is based primarily upon the results of the Expedition of the California Academy of Sciences to the Galapagos Islands during 1905 and 1906 in the schooner *Academy*. The Expedition was planned and organized by myself in my official capacity as Director of the Museum of the California Academy of Sciences. Mr. Rollo Howard Beck was placed in command of the Expedition and its marked success was due chiefly to his sound judgment, strength of character, great physical endurance, and skill as a collector and preparator. In the preparation of the bird skins he was assisted by Mr. Edward Winslow Gifford and Mr. J. S. Hunter. Mr. Gifford kept the ornithological diary, and the portions relating to the albatrosses and petrels are incorporated in substance in the following pages. His observations were recorded with great attention to detail and add much to our knowledge. The Expedition sailed from San Francisco on June 28, 1905, and returned November 29, 1906. On the outward voyage stops were made at various islands along the west-coast of Lower California and at San Benedicto, Socorro, Clipperton, and Cocos islands. A year and a day were spent at the Galapagos Islands and in the immediate vicinity. No stops were made during the homeward voyage. Owing to calms and unfavorable winds, it consumed sixty-five days. The ornithologists availed themselves of every opportunity to collect albatrosses and petrels at sea. During calms Mr. Beck was continually out in a skiff, and secured numerous specimens that are rare in collections.

The Galapagos Expedition material has been supplemented by specimens and notes taken by Mr. Beck off Point Pinos, California, at intervals between March 1, 1903, and July 13, 1910, while employed as chief field assistant of the California Academy of Sciences.

In some instances I have included observations made by Mr. Alexander Sterling Bunnell and Mr. Beck while on the Expedition of the California Academy of Sciences to the Revilla Gigedo Islands, Mexico, in the schooner *Mary Sachs*. The Expedition left San Francisco April 25 and returned August 13, 1903. It was planned and organized by myself, as Director of the Museum of the Academy. Unfortunately, all the specimens obtained were destroyed in the San Francisco conflagration of April, 1906.

During the autumn of 1911 I visited the principal museums of the United States and examined the albatrosses, petrels, and diving petrels in their collections. Many specimens have been lent to me by museums and individuals for comparison, and acknowledgment of this assistance has been made in my introductory remarks.

The specimens of albatrosses and petrels in the museum of the California Academy of Sciences number over two thousand, and at the time of this writing constitute the largest collection of these birds in the United States.

To bring to the work in hand fresh impressions of the bird life of the sea, I revisited Monterey, California, in December, 1912, and made numerous excursions in a gasoline launch to the ocean off Point Pinos.

MEASUREMENTS.—With the exception of the few diving petrels, treated in part V, all the specimens were measured by my young friend, Mr. Edward Winslow Gifford, formerly Assistant Curator of the Department of Ornithology in the California Academy of Sciences and now Associate Curator of the Anthropological Museum of the University of California. Over thirteen thousand measurements were taken by him, forming a series unparalleled in the albatrosses and petrels. Unless otherwise stated, all measurements refer to specimens in the collection of the California Academy of Sciences. In measuring the wing from the carpal joint to the tip of the longest primary, the primaries were flattened against the surface of the rule, giving a dimension greater than the chord. The length of the culmen is the chord of the exposed culmen, and was taken with dividers. The depth of the upper mandible is the distance between the base of the exposed cul-

men and a point directly below it on the tomium, and the width of the upper mandible is the diameter at the base of the exposed sides of the mandible; the former dimension being taken with dividers and the latter with a 15 cm. caliper square. The length of the tail is approximate, and was obtained by inserting one point of the dividers into the base of the tail between the two middle rectrices and extending the other point to the end of the longest rectrix. In some instances the total length and the extent are given. They were taken in the flesh by the collectors, and have been copied by Mr. Gifford from the labels of the specimens.

Colors.—In determining colors, I have been guided by Mr. Ridgway's *Nomenclature of Colors* and his *Color Standards and Color Nomenclature.*

Synonymy.—The synonymy relates to the monographs of Dr. Coues, Mr. Salvin, and Dr. Godman, referred to at length in part I.

Diomedea nigripes *Audubon:* Black-footed Albatross

Coues—*Diomedea nigripes,* V, 178, 187; *Diomedea gibbosa,* V, 180, 187.
Salvin—*Diomedea nigripes,* 440, 445; *Diomedea gibbosa,* 455.
Godman—*Diomedea nigripes,* liv, 332, pll. 94, 95.

In his monograph Mr. Salvin includes *Diomedea gibbosa* Gould as one of the doubtful species yet to be identified,[1] overlooking Dr. Streets's remarks on the subject published nineteen years before.[2] All the characters of plumage ascribed to *"D. gibbosa"* were found by Dr. Streets in specimens of *Diomedea nigripes* captured at sea between Honolulu and San Francisco.

The eighty-one examples of *D. nigripes* in the collection of the California Academy of Sciences confirm the statements of Dr. Streets and also explain the peculiarities of bill set forth by Gould in the original description.[3] At one extreme of the series are birds having the abdomen and upper and lower tail-coverts dark, at the other are birds having these parts

[1] P. 455; cf. Sharpe, Hand-List, v. 1, p. 128, footnote.
[2] Bull. U. S. Nat. Mus. No. 7, p. 31.
[3] Ann. and Mag. N. H., 1844, v. 13, p. 361.

more or less white. A male (No. 10003, Monterey Bay, Calif., Aug. 2, 1907) typically exemplifies *"D. gibbosa"*. The abdomen and upper and lower tail-coverts are white, partially clouded on the abdomen by the gray tips of some of the feathers. The white of the head is much extended. The upper mandible is "swollen and raised" and "rises high up on the forehead." In another male (No. 10004, Monterey Bay, Calif., July 18, 1907) the bill is even more swollen, but the white of the abdomen and upper tail-coverts is obscured by the dark tips of the feathers. Like variations in the form of the bill occur in *D. irrorata*.

In some of the specimens new white feathers with dark tips have made their appearance beneath the surface in the posterior white areas. At first glance these sprouting feathers seem to be new dark ones appearing amongst the old white feathers. A similar stage in the moult evidently misled Mr. Salvin into the belief that dark birds are the adults.[1] In reviewing the British Museum material, Dr. Godman states in general terms that he fails to find support for Mr. Salvin's conclusion.[2]

While it is believed that the white coloration is due to advancing maturity and not to dichromatism, the specimens in the Academy's collection do not fully complete the chain of evidence. Judging from those in hand, the white of the abdomen and tail-coverts probably appears first at the base of the feathers, then extends with successive moults, finally prevailing over the dark color. Both on the head and the posterior parts the wear of the feathers assists in enlarging the white areas. The basal portions of the tail also probably whiten in the progress towards maturity. A Laysan Island female (No. 5615 Stanford Univ.), passing from the natal down into the definitive feathers, exhibits no trace of white on the abdomen and tail-coverts.

Although seven months of the year are represented in the dates of capture, the Academy's series is not strong except in July and November specimens; of the former there are eighteen and of the latter fifty-five. Three June specimens and the July ones are undergoing a moult that is apparently postnuptial.

[1] Monograph, p. 446.
[2] Mon. Petrels, p. 334.

In the November specimens, moulting is still progressing, old feathers are more or less prominent, and in some instances new feathers have begun to fade. Twelve of the November specimens are much worn and bleached, having lagged far behind in the renewal. In fresh plumage, the forehead, back of the white frontal feathers, is light gray, shading into sooty gray on the crown, occiput, cervix, and sides of neck; the jugulum is lighter sooty gray, changing into pale drab-gray on the breast, cheeks, and throat, finally becoming very pale gray on the chin; the sides are dark drab-gray and the interscapulars are sooty gray with slightly lighter margins. Authors as a rule have overlooked this fresh plumage, and have described faded birds of a brownish cast. No. 1288 C. A. S. has fourteen instead of twelve rectrices.

In this species there is a lack of uniformity in the order of renewal of the primaries; a fact which Dr. Stone has already brought to the attention of ornithologists.[1]

The appended table exhibits the dimensions in millimeters of twenty-eight males and forty-nine females. Owing to loss of primaries in moulting, the wing measurement was not taken in five males and six females.

	Sex	Wing	Tail	Culmen	Upper Mandible		Tarsus	Middle Toe and Claw
					Depth	Width		
Maximum...	♂	533	162	113	30.3	34.5	94.5	130
Minimum...	♂	488	130	102	26.6	30	87.2	116.9
Mean.....	♂	515	144	108.3	28.8	31.7	91	123.5
Maximum...	♀	530	150	110.4	29.9	33	93	129
Minimum...	♀	485	130	94.4	26	27.1	80.9	109
Mean.....	♀	506	141	101.2	27.8	29.8	85.6	117.6

As in *Diomedea irrorata,* the females average smaller than the males.

During the southward voyage of the schooner *Academy,* Black-footed Albatrosses ceased being common about latitude 28° N. The last, two individuals, were seen July 21, 1905, in latitude 23° 32′ N., longitude 113° 4′ W. On the home voyage, they were picked up again on November 1, 1906, in latitude 26° 24′ N., longitude 126° 23′ W. On November 18,

[1] Proc. Acad. Nat. Sci. Phila., 1900, pp. 14, 15.

latitude 35° 14′ N., longitude 132° 49′ W., they were particularly common, a score or more often being in attendance on the *Academy;* eighteen were caught with hook and line. During the Revilla Gigedo Expedition, in 1903, the last one on the passage south was seen May 9 off Natividad Island, about latitude 27° N. On the return voyage the first were met with July 19, in latitude 24° N., longitude 122° W. Mr. A. W. Anthony reports a solitary individual in May in the vicinity of Clarion Island, about latitude 19° N.[1] It therefore appears that the southern boundary of this albatross's range on the American side of the Pacific is near the Tropic of Cancer.

Inshore in the latitude of middle California, Black-footed Albatrosses are apparently of irregular occurrence, but offshore they seem to be present the year round, indicating that all the individuals of the species do not occupy the breeding stations at the same time of the year.

Diomedea albatrus *Pallas:* Short-tailed Albatross

Coues—*Diomedea brachyura,* V, 177, 187; (?) *D. leptorhyncha,* V, 178, 187.
Salvin—*Diomedea albatrus,* 440, 444.
Godman—*Diomedea albatrus,* liii, 326, pl. 92.

It has not been satisfactorily determined how far south this albatross ranges, several other albatrosses having been confounded with it. Dr. Brewer's account of this species in *The Water Birds of North America* clearly relates to three albatrosses, the Short-tailed, the Black-footed, and the Laysan.

Off Point Pinos, California, I found the Short-tailed Albatross quite common in December, 1894, and January, 1895,[2] and again during the latter half of September, 1896.[3] It seems, nevertheless, to be of irregular occurrence in that vicinity, for it escaped the observation of Mr. R. H. Beck during several seasons between 1903 and 1910, and was not met with by myself during December, 1912. Its presence off Southern California is well authenticated. However, in some instances the Laysan Albatross may have been mistaken for

[1] Auk, v. 15, p. 317.
[2] Proc. Calif. Acad. Sci., 2d ser., v. 6, p. 25.
[3] Proc. Calif. Acad. Sci., 3d ser., Zool., v. 2, p. 319.

the boreal bird. Several years ago I examined in the Field Museum of Natural History two specimens of the Short-tailed Albatross (No. 33501 and No. 33502) from "San Martin, Lower California," and in the Carnegie Museum a single specimen (No. 21881) from "Rosario Bay, L. C."

The eggs are apparently unknown. Dr. Godman in his *Monograph of the Petrels* ascribes a dozen time-honored specimens from the Bonin Islands to this species, but the Bonin Islands are within the range of the Laysan Albatross. It is probable that the breeding grounds will be found above latitude 50° N., for Dr. Dall has reported "the mutilated carcass of a very young one, in August, at Atka."[1]

When at the United States National Museum in 1911, I failed to find the skull upon which *Diomedea leptorhyncha* Coues was founded, the specimen having been mislaid or lost.

The records of the occurrence of the Wandering Albatross in the region embraced by the present section of this paper are not satisfactory.

Diomedea irrorata *Salvin:* Galapagos Albatross

Plates 6-12

Salvin—*Diomedea irrorata,* 440, 445, pl. 8.
Godman—*Diomedea irrorata,* liv, 330, pl. 93.

Mr. Gifford's observations tend to show that this albatross is absent from the immediate vicinage of the Galapagos Islands for a portion of the year, particularly December, January, and February. As the type and a second specimen (No. 212017 U. S. Nat. Mus.) were obtained on the coast of Peru in December,[2] it is not improbable that this species has a migration in the Southern Hemisphere corresponding to that of the Black-vented Shearwater in the Northern Hemisphere, a migration after the breeding season in a direction not towards, but away from the Equator.

Mr. Gifford's notes in substance are as follows: They were rather common at sea in the southern portion of the archi-

[1] Proc. Calif. Acad. Sci., v. 5, p. 277.
[2] The type is a male and was secured by Admiral A. H. Markham at Callao Bay (P. Z. S., 1883, p. 430). The U. S. National Museum specimen is a female and was taken by Dr. Robert E. Coker at Lobos de Tierra.

pelago, but elsewhere offshore only occasional individuals were met with. Two were seen June 22, 1906, about forty miles south of Charles Island, two September 14, 1906, near Tower Island, in the Northern Hemisphere, two September 23, 1905, about seventy-five miles southeast of Chatham Island, and one near Brattle Island on October 30, 1905. These outlying birds roughly define the range as noted by Mr. Gifford. Away from the Galapagos Islands, there are apparently no records of occurrence save those mentioned above from the Peruvian coast.[1]

The first visit to the rookery on Hood Island was made during the last week in September, 1905. Many addled eggs and many adult birds in worn plumage were found, but only one young-of-the-year, a male passing out of the down. Every time the parent snapped its bill, this youngster would bow its head until its bill touched the ground. Salutations seemed to be the vogue. Whenever one bird passed another, each would snap its bill, apparently in greeting. When the sun was hot, the albatrosses often sought shelter in the shade of the bushes, sitting flat on the ground. A single instance of revival of the erotic ardor was witnessed. The apparent absence of the young-of-the-year during this visit is surprising, particularly as the Webster-Harris Expedition met with them in numbers during the last week of October, 1897.[2]

As before mentioned, a hiatus apparently occurred after the season of reproduction, not a single albatross being seen between November and May. A visit to Hood Island during the first week of February, 1906, revealed only addled eggs and feathers.

The last week of June, 1906, thousands were breeding on the southern part of Hood Island, occupying the open spaces among the bushes and rocks (plates 6-8), from the shore back to an elevation of three or four hundred feet. Some shared the nesting quarters of the Man-o'-war-birds (plate 6). Generally they had no neighbors except an occasional booby. The season for fresh eggs was nearly over, only two being taken;

[1] Since the account of this species was completed, additional occurrences off Peru have been reported—see Paefsler, J. f. O., 1913, v. 61, pp. 42, 45; 1914, v. 62, p. 277.
[2] Nov. Zool., v. 6, p. 99.

but eggs in an advanced stage of incubation and birds a week or two old were abundant. The single egg was laid on the bare ground, usually in a slight depression.

The nestlings sat bolt upright or lay stretched out on the ground. When the sun was out they moved about a little. The old birds were very solicitous in the care of the young, sheltering them during drizzling weather and warning off Galapagos Hawks or human intruders by snapping the bill threateningly.

The breeding grounds appear to be restricted wholly to Hood Island, no evidence of breeding being discovered on any of the other islands.

The curious albatross pastime, variously styled billing, fencing, and dancing, was of constant occurrence on Hood Island in September, 1905, and June, 1906; although the view was obstructed by rocks and bushes, a glance anywhere over the rookery always revealed one or more pairs in action. Standing opposite one another, each bird threw its head up, the bill in this position being nearly or quite vertical, then the pair bowed, then fenced for perhaps a minute, using the bills as foils. Other features were often added, which did not seem to have any regular order. In these the birds usually performed alternately. While one was doing the stunt, the other assumed a statuesque pose, standing very erect, intently watching the performance. At its conclusion, the two joined in a fencing bout. Then the second bird performed, and afterwards the fencing was repeated, and so on to the finale. The additions were as follows: 1. Bird touched ground beside it with bill; 2. Mouth was opened very wide; 3. Bill was pointed straight upward and a moaning note uttered; 4. Bird reached around and touched wing with bill. Occasionally a third bird took part at the beginning, but one soon dropped out. Sometimes two birds go through the fencing exercise with one or both sitting (plate 7). Often when a person bows to an albatross immediately after a performance, the bow will be returned.

When disturbed, these albatrosses displayed signs of anger by raising the feathers of the head, notably those over the eyes

(plate 8), and by viciously snapping the bill. On one occasion when a bird was being chased, its mate left the egg and followed in pursuit for fifteen or twenty yards, menacing with its bill.

Unlike the Black-footed Albatross of northern waters, this species usually gave the schooner *Academy* a wide berth. One day when anchored at Barrington Island in July, two or three individuals came to the vessel, attracted by some seal fat that was being thrown overboard. Only one, however, overcame its caution sufficiently to alight and feed.

In walking, the gait was slow and the head was swayed from side to side, in a way keeping time with their steps. They were often seen standing with their tarsi flat on the ground, as ostriches are wont to do in confinement.

"The adults have a hoarse croaking note which seemed to be used in anger and in talking to the young and to each other. Often an adult would look down at its young and utter several hoarse notes." Another note was a sort of moan uttered when alone or when in company with another bird and usually with neck outstretched and bill pointing upwards. The young, a few days old, had a kind of chuckle which was given in a rather high key.

At Hood Island the stomachs of the adults were often empty. Many were filled with a greenish or a brownish oily fluid about the consistency of milk. When molested, the old and young ejected this fluid; in several instances old birds also disgorged the remains of squid. The young were fed by regurgitation, the lower mandible of the parent serving as a sort of dish. Internal parasites were found in the alimentary tract of adults.

The Expedition brought back seventy-seven specimens of this albatross, sixty-five adults and eight nestlings in the skin, two adults in the flesh in formalin, and two skeletons of adults. With the exception of an adult male from the vicinity of Barrington Island, taken July 10, 1906, all were obtained on Hood Island between September 24 and October 3, 1905, and between June 23 and July 3, 1906.

The eight nestlings exhibit a definite dichromatism; a light phase, typically manifested in No. 1180, female, June 28, and

a dark phase, typically manifested in No. 1185, male, June 30. The general aspect of the former is light drab-gray; that of the latter dark drab, medially lighter below and varied with dull cream color above, especially anteriorly (plates 9, 10). Both specimens are densely clothed in primary natal down. The secondary natal down is beginning to appear on the lower parts. Obviously, the dual coloration is not caused by the wearing off of a terminal segment of down. The specimens are also in the egg tooth stage. Their dimensions are: light phase, culmen 34.7 mm., tarsus 20, middle toe and claw 27.5; dark phase, culmen 39.3 mm., tarsus 22, middle toe and claw 30.5. No. 1183, June 25, is similar to No. 1180.

No. 1181, extreme light phase, male, June 30, is considerably larger than the specimens described, the culmen measuring 55 mm., tarsus 35.6, middle toe and claw 45. The secondary natal down is well advanced, and the primary natal down is much worn on the lower parts, particularly on the abdomen, which is nearly bare. This specimen was prepared by Mr. Beck especially to show the natal down of the upper parts as it appears in life (plate 11). On these parts and on the jugulum and sides of neck the primary natal down is united apically into tufts, the apex of each tuft appearing as if it had been twirled between the fingers. In color the tufts are light drab-gray, subterminally creamy white, and often apically dark brown. The creamy white predominates on the jugulum, sides of neck, and anterior upper parts, and the dark brown is most conspicuous on the top of the head, cervix, and sides of the neck. The chin, throat, lores, and circumocular region are nearly naked. Posterior to the jugulum, the worn primary natal down of the lower parts is light drab-gray. On most of the areas the secondary natal down is lighter than the basal part of the primary natal down.

Of the other June and July nestlings, No. 1182 is in the light phase, and Nos. 1184 and 1205 are intermediate, the former inclining to the dark and the latter to the light phase. All have entered the double-down state.

No. 1204 (dark phase, male, September 25, culmen 98 mm., tarsus 73, middle toe and claw 90.3) is passing from the natal

down into the postnatal plumage. On the upper parts, hidden beneath the natal down, dark mouse gray scapulars and white postnatal down have made their appearance. On the breast and sides contour-feathers like those of the darker breeding birds are emerging at the base of the secondary natal down. The chin is nearly bare and the throat rather sparsely covered with dark brown natal down, interspersed with filoplumes, which are also present on the sides of the head. The bill is similar in shape to that of an adult, but in all the other nestlings it is strongly decurved. According to Mr. Gifford, the color of the bill in nestlings was dark olive, tipped with a lighter tint of olive. Heretofore, nestlings of this species have been undescribed.

There is considerable variation in the general form and proportions of the bill in the series of breeding albatrosses taken on Hood Island during the eight days ending July 2, 1906. For example, the basal width of the upper mandible in Nos. 1199 and 1221 (both males) is respectively 35.2 mm. and 31 mm., and the depth of the concavity of the culmen in Nos. 1208 and 1225 (both females) is respectively 6.5 mm. and 2.5 mm. (plate 12). It is evident that the value of structural bill characters in the albatrosses can be fully determined only by the study of extensive series.

The plumage of the breeding birds varies considerably in color and differs somewhat from the descriptions in the books. There is no "slight shade of grey on the sides of face and over the eyes," as is stated by Dr. Godman to be the case in the type.[1] It may be that this gray coloration is peculiar to the fresh plumage. The white of the head and neck is more or less tinged with yellow, intensified on the anterior portion of the jugulum. In several specimens the forehead is decidedly yellow. The yellow wash of top of head, cervix, and side of neck varies; in some specimens it is Naples yellow, in others buff-yellow, and in others still both colors are present. The scapulars and interscapulars are plain smoky-brown in certain specimens. The light and dark markings of the upper back, sides

[1] Mon. Petrels, p. 331.

of breast, and upper and lower tail-coverts are much coarser in some examples than in others. Their relative prominence also varies, giving the surfaces as a whole a lighter or darker appearance. The general aspect of the lower parts is lighter in some specimens and darker in others. In the extreme light manifestation, the breast, abdomen, and sides are finely vermiculated with white and gray, growing darker laterally and posteriorly. In the extreme dark style the vermiculations are coarser and the flanks and abdomen are nearly uniform dark gray. The tail is smoky-brown, becoming white on the concealed portion. "The colors of the naked parts of the adults in life were as follows: Bill yellow; bare skin in interramal space azure blue; iris dark brown; orbital ring black; feet pale bluish" (*Gifford*). No. 1237 C. A. S. has thirteen rectrices.

One specimen, obtained June 28, is in good feather, and is apparently just finishing a moult. In two other summer specimens the plumage is in fair condition, but in the rest of them it is worn. The autumn specimens are generally much worn, and many of them are replacing the feathers of the breast and abdomen, the postnuptial moult having commenced.

In the subjoined table are the dimensions in millimeters of twenty-two males and forty females.

	Sex	Wing	Tail	Culmen	Upper Mandible		Tarsus	Middle Toe and Claw
					Depth	Width		
Maximum...	♂	593	158	160	33.6	36	103	138
Minimum...	♂	550	137	142	30.3	31	91	125
Mean.....	♂	568	147	151.4	31.7	33.5	95	131.8
Maximum...	♀	586	150	156.8	32.7	34	99.9	135
Minimum...	♀	510	129	134.2	28	29.5	87	116
Mean.....	♀	547	139	141.4	30.5	32	92	125

In the flesh the length of five males in millimeters was 890, 890, 905, 920, 935 and of four females 850, 865, 870, 870. The extent in a single male was 235 cm. and in a female 232 cm.

It is apparent from the measurements given above that the females average smaller than the males.

DETAILED MEASUREMENTS (in millimeters) OF SPECIMENS TAKEN ON HOOD ISLAND DURING THE EIGHT DAYS ENDING JULY 2, 1906

No.	Sex	Wing	Tail	Culmen	Upper Mandible		Tarsus	Middle Toe and Claw
					Depth	Width		
1174	♂	570	150	156.5	33.6	32.1	93	131.6
1199	♂	579	146	146	31	35.2	97	128.4
1201	♂	570	156	150	31.2	32.5	93	130
1209	♂	559	146	149.8	32.2	33	91	129.9
1213	♂	565	145	158.8	32.1	32.9	95.5	135.5
1214	♂	575	158	151	31.4	33.3	94	133
1221	♂	593	148	148	31	31	97	131
1223	♂	565	143	154	31.5	33.9	93.2	129.7
1230	♂	566	145	157	31.1	34.6	94	127
1233	♂	585	153	155	31.9	34.4	97.8	136.8
1234	♂	577	142	156	31.6	33.7	97	138
1239	♂	582	152	154	32.2	34	103	137
1243	♂	550	144	149	33	33.9	94	125
1246	♂	575	153	160	30.3	33.4	94.5	130
1175	♀	552	139	147	31.2	31.6	93.5	127.4
1179	♀	558	148	134.8	29.8	30.9	93	125.5
1190	♀	556	136	140	30	30	91.5	123
1195	♀	544	136	143.3	29.9	31.4	88.5	124
1196	♀	538	140	140.6	31.6	33	94.3	131
1197	♀	542	137	137.3	30.3	32.6	91	124
1200	♀	540	139	142	31.9	33.5	91.5	122.5
1202	♀	552	134	142	31.2	31.9	93	126.3
1208	♀	560	144	143	31	32.5	92.9	128.2
1211	♀	540	134	138	29.6	31.2	89.8	124
1225	♀	536	139	148.8	31	32.7	92	122.1
1226	♀	551	139	136.3	29.8	33.2	92.4	122
1235	♀	538	139	145.9	31.6	31.1	94.4	126.9
1236	♀	543	136	139	30.1	32	90	126
1237	♀	555	134	141.2	30.1	32.3	90.9	124
1238	♀	535	140	137.3	30.4	32.6	89.5	121.4
1242	♀	558	142	138	30.1	33.4	88.3	121.5
1244	♀	565	146	142.9	32.6	31.3	91.3	128.6
1245	♀	556	142	144.8	30.9	30.6	93	131.4

Eight badly bleached eggs of this species were preserved in addition to the two fresh ones previously referred to. All were collected on the same day, June 27. They exhibit considerable variation in form, ranging from nearly oval to elliptical oval, elliptical ovate, and elongate ovate. The two fresh specimens have a dull whitish ground. The larger end of each is irregularly capped with more or less confluent spots, lines, and blotches of cinnamon-rufous and bay. The remainder of the shell is speckled with the same colors. The specimens measure in millimeters: 99.6 x 65.5; 103.4 x 72; 105.4 x 67.5; 107.4 x 68.6; 108.1 x 70.5; 108.4 x 64.4; 108.7 x 66.5; 108.8 x 69.6; 111.7 x 69; 112.5 x 68.7.

Diomedea immutabilis *Rothschild:* Laysan Albatross

Salvin—*Diomedea immutabilis,* 440, 446.
Godman—*Diomedea immutabilis,* liv, 336, pl. 96.

Since Mr. Anthony's announcement[1] of the capture of a specimen on March 17, 1897, "between San Geronimo Island and Guadalupe Island," Lower California, information concerning the presence of this species in North American waters has not been forthcoming.

None were encountered by the Galapagos Expedition on the way south, late in June and early in July, 1905, but during the homeward voyage, in 1906, two males in worn livery were taken. One of them, which was the first individual met with, was shot on November 3 in latitude 26° 51′ N., longitude 126° 52′ W.; the other was shot on November 14 in latitude 33° 7′ N. and longitude 134° W., off southern California. According to Mr. Gifford's observations, nine others were seen. The last one was noted on November 24 in latitude 37° 55′ N., longitude 132° 37′ W. "It circled about astern a good many times over three or four Black-footed Albatrosses that were resting on the water." While it is possible that some of the white albatrosses seen may have been the Short-tailed, a mistake could hardly have been made in those closest at hand.

If pelagic birds occurring on the high sea a few hundred miles offshore are to be considered Californian, then the Laysan Albatross should hereafter be included in the list of California birds.

Dr. Tarleton H. Bean has reported the Spectacled Albatross (*Thalassarche melanophris*) from the northeast Pacific on the strength of a solitary white albatross seen by him on October 31, 1880, in latitude 40° 30′ N., longitude 142° 23′ W.[2] This position is within the probable range of the Laysan Albatross, which was undescribed at the time of Dr. Bean's writing, and which is sufficiently like the Spectacled Albatross in color to be mistaken for it. Without comment, Dr. Godman relegates the record to the synonymy of *D. immutabilis.*

In two males and a female (Nos. 5611, 5613, 5610 Stanford Univ.), obtained during the latter part of May on Laysan

[1] Auk, v. 15, p. 38.
[2] Proc. U. S. Nat. Mus., v. 5, p. 170.

Island, the top of head, cervix, and sides of neck are tinged with yellow, and the malar region, auriculars, chin, and throat are more or less tinged with gray. The yellow is faintly indicated in the two November males of the Expedition (Nos. 1315, 1316). These peculiarities of coloration are not noted in the original description of the species or in the other descriptions consulted.

The five specimens of *D. immutabilis* mentioned above yield the following measurements in millimeters:

No.	Sex	Wing	Tail	Culmen	Upper Mandible		Tarsus	Middle Toe and Claw
					Depth	Width		
1315	♂	491	136	100	25.3	27	81.5	110.4
1316	♂	474	133	111.9	26.1	28.9	80	107
5611[1]	♂	500	150	108	27	30.4	84.8	116
5613[1]	♂	493	151	108.5	28.2	33	84.8	119.5
5610[1]	♀	495	146	102	27.1	31.5	82	112

Thalassarche culminata (*Gould*): Culminated Albatross

Coues—*Diomedea culminata,* V, 183, 188.
Salvin—*Thalassogeron culminatus,* 449, 451; *Thalassogeron eximius,* 449, footnote.
Godman—*Thalassogeron culminatus,* liv, 354, pl. 101; *Thalassogeron eximius,* liv, 360.

Audubon says: "A skin of this bird was sent to me by Dr Townsend, who procured it in the Pacific Ocean, not far from the mouth of the Columbia River."[2] This specimen is preserved in the United States National Museum; its catalogue number being 2726.

Dr. Brewer remarks: "Dr. Cooper has, however, seen a skull answering to the description of that of this species in the collection of the Academy of Natural Sciences in San Francisco. It was taken by Dr. W. O. Ayres from a dead specimen found on the outer beach near the Golden Gate."[3] This skull, wanting the lower jaw, was in the research collection lost by the Academy in the Conflagration of April, 1906. Its label established its identity as the Ayres specimen. The culmini-

[1] Stanford Univ.
[2] Orn. Biog., v. 5, p. 326.
[3] Water Birds N. A., v. 2, p. 359; cf. Cooper, Proc. Calif. Acad. Sci., v. 4, p. 12.

corn and latericorn were largely intact, enabling me to corroborate the original identification. Dr. Ayres was one of the earlier members of the Academy and well-known in his day as an ichthyologist.

"A specimen of this Albatross said to have been procured in the Bay of Panama by Mr. Bridges is in the collection of the British Museum."[1]

Capt. R. Paefsler has recently recorded the occurrence of this species in latitude 5° 1′ S., longitude 81° 1′ W.[2]

So far as I am aware, there are no other records for the region under consideration.

Gould's type (now in the Academy of Natural Sciences of Philadelphia) and original description appear to me to be a surer means of determining the specific name of the present species than J. R. Forster's original *D. chrysostoma* description, which is not altogether definite when *T. bulleri* is considered.[3] Forster's *chrysostoma* is therefore rejected and Gould's *culminata* retained.

The original account and plate[4] clearly manifest that *Thalassogeron eximius* Verrill was based primarily upon a misunderstanding of the bill characters of *T. culminata* and *T. chlororhynchos.* The account states that the supposed new species is more closely related to *T. chlororhynchos* than to *T. culminata,* while figure 2 of the plate plainly shows that the culminicorn is rounded at the base as in *T. culminata,* and not pointed as in *T. chlororhynchos.*[5] The color characters assigned are of the sort occurring commonly in variations that are not of specific import. *"T. eximius"* is therefore consigned to the synonymy of *T. culminata.*

Thalassogeron desolationis Salvadori has apparently no better support than such shadowy characters as variation in the length of the outer toe and in the width of the membrane at the base of the culminicorn.[6]

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[1] Biol. Centr.-Amer., Aves, v. 3, p. 438; refer also to Salvin's monograph, p. 451. According to Dr. Dall, Thomas Bridges was in Panama in 1855 (Memorial Sketch, Proc. Calif. Acad. Nat. Sci., 1866, v. 3, pt. 3, p. 236).

[2] "Den 13. Mai in Païto in 5, 1° S 81, 1° W: *Oceanites tethys, Puffinus griseus, Thalassogeron culminatus* viele." J. f. O., 1913, v. 61, p. 50.

[3] Cf. Mém. Math. et Phys. prés. Acad. Roy. Sci. [Paris], 1785, v. 10, p. 571, pl. 14; Mathews, Birds Austr., v. 2, p. 278.

[4] Trans. Conn. Acad. Art. Sci., v. 9, pp. 440-443, pl. 8.

[5] Cf. Salvadori, Ibis, 1914, p. 504.

[6] Cf. Salvadori, Ibis, 1914, p. 506; orig. descr., Boll. Mus. Zool. Anat. comp. Univ. Torino, 1911, v. 26, No. 638, p. 2.

Phœbetria palpebrata (*J. R. Forster*): SOOTY ALBATROSS

COUES—*Phœbetria fuliginosa*, V, 186, 188.
SALVIN—*Phœbetria fuliginosa*, 453.
GODMAN—*Phœbetria fuliginosa*, Iv, 363, pl. 103; *Phœbetria cornicoides*, Iv, 367.

"The skin from which I made my drawing of this species was prepared by Dr Townsend, who procured the bird near the mouth of the Columbia River."[1]. This historic record of Audubon appears to be the only one which comes within the limits defined in the present part of this paper. The specimen mentioned is now housed in the United States National Museum; bearing the catalogue number 2718.

Dr. Godman recognizes two species in the genus *Phœbetria*. Of the lighter of these supposed species, he states: "It may at once be distinguished by its grey-brown back and underside; the groove, too, in the under mandible is smaller and narrower and in most specimens is of a pale blue."[2] The gray aspect of the plumage is not necessarily of specific significance; that it is not a mere color phase remains to be proved. The variation in the bill is not more singular than that displayed in *Diomedea albatrus*,[3] *Diomedea nigripes*, and *Diomedea irrorata*. As shown in part IV, distribution is a factor in dichromatism.

Macronectes giganteus (*Gmelin*): GIANT FULMAR

COUES—*Ossifraga gigantea*, III, 32.
SALVIN—*Ossifraga gigantea*, 422.
GODMAN—*Macronectes giganteus*, xlix, 261, pl. 76.

So far as known to me, there is but a single record supported by a specimen for the region in question. It is by Audubon, and is as follows: "A specimen of the Gigantic Fulmar, shot at some distance from the mouth of the Columbia River, has been sent to me by Dr Townsend, along with those of the other species of the same genus described in this volume, and which it resembles in form and proportions."[4] The specimen is now in the United States National Museum, catalogued as No. 2743.

[1] Orn. Biog., v. 5, p. 116.
[2] Mon. Petrels, p. 367.
[3] Cf. Shufeldt, Auk, v. 2, p. 175.
[4] Orn. Biog., v. 5, p. 330.

Mr. Cassin, in his report on the birds of the Wilkes Expedition, says: "This large species was frequently observed during the voyage of the Expedition, and is entitled to be regarded as a bird of North America, specimens in the collection having been obtained on the coast of Oregon."[1] I found no specimen in the United States National Museum substantiating this statement. Dr. Richmond, after kindly examining the Museum archives for me, writes, "I can find no record of *Macronectes giganteus* from Oregon in our catalogues. There are records of three specimens collected by the U. S. Exploring expedition; two of them have no localities given in the catalogues, and the third is from Orange Bay, Tierra del Fuego."

In conversation with Dr. Cooper, several years before his death, I learned that his notice[2] of the occurrence of the Giant Fulmar near Monterey, California, was not based upon examples actually in hand, but merely upon birds seen in the vicinity of the whale fishery, and that his identification was inadequate, the style of the nasal tubes not being noted. In all probability, the birds observed were Black-footed Albatrosses, which are not mentioned by him as being among those species attracted by the scraps from the "try-works" of the whale fishery.

Fulmarus glacialis (*Linnæus*): Fulmar

Coues—*Fulmarus glacialis,* III, 27; *Fulmarus pacificus,* III, 28; *Fulmarus Rodgersii,* III, 29.
Salvin—*Fulmarus glacialis,* 424, 425; *Fulmarus glupischa,* 424, 427; *Fulmarus rodgersi,* 424, 427.
Godman—*Fulmarus glacialis,* xlix, 265, pl. 77; *Fulmarus glupischa,* 1, 270, pl. 78; *Fulmarus rodgersi,* 1, 273, pl. 79.

On the home voyage of the Expedition, the first Fulmar was secured on November 9 off Lower California in latitude 30° 30′ N., longitude 130° 55′ W. According to Mr. Gifford's notes, Fulmars were observed almost every day thereafter up to the 26th, in latitude 36° 43′ N., longitude 129° 31′ W. Seventeen specimens were preserved. All of them are of the dark phase.

In the vicinity of Point Pinos, California, individuals have been noted by Mr. Beck or myself in nearly every calendar

[1] U. S. Expl. Exp., 1858, p. 407.
[2] Amer. Nat., v. 4, p. 758.

month. The July and August birds, however, appear to be mere loiterers out of health. Visitors from the breeding grounds do not begin to arrive in force before October. In November and during winter they often become very common, but they are extremely irregular, and even a season may pass with few or none being met with. Usually the dark phase greatly outnumbers the light. In 1904, Mr. Beck found Fulmars common as late as April 15.

The Academy's series of two hundred and fifty-seven Pacific specimens, chiefly from the vicinage of Point Pinos, California, throws considerable light on the various plumages assumed by this species.

It is made evident by this series that *Fulmarus rodgersi* Cassin is merely a nominal species. The intergradation is complete between birds of the light phase having the upper parts smoky gray, lighter on top of head and hind neck, and birds having mantle, tail, and inner webs of primaries almost wholly white.

In my second paper on California water birds, attention was called to an extreme example of the light phase from San Francisco Bay having the mantle entirely white.[1] According to Dr. Godman, "occasionally pure white individuals are met with"[2] on the North Atlantic, evidencing that the whitening of the mantle is not confined to birds breeding in the vicinity of Bering Strait.

As specimens of the Academy's series grade from apparently immature birds into those with the white mantle, it is probable in the light phase that the whiter birds are the more aged. This, however, can not be proved conclusively from available material, collected as it has been on the ocean remote from breeding stations, with no examples showing the transition from the natal down to the definitive feathers. In short, it apparently remains to be determined by specimens whether the birds of the light phase grow whiter with age or whether they pass from the natal down to the various aspects of that phase without intermediate stages; with age eliminated, there would then remain dichromatism and geographic variation as possible factors.

[1] Proc. Calif. Acad. Sci., 2d ser., v. 6, p. 27.
[2] Mon. Petrels, p. 267; see also pl. 77.

In the Academy's series, the coloration in the dark phase ranges from dark mouse gray to smoke gray above, and from drab-gray to pale smoke gray below. In the light phase the coloration ranges from nearly uniform white to olive-gray above, and from all white to white suffused with gray below. Between pale examples of the dark phase and dark examples of the light phase are intermediates not readily assignable to either phase. Whether the connecting birds are immature or not is an open question.

In extreme light birds, the white of the mantle is increased by bleaching and wearing off of the gray tips of the feathers. Faded examples of dark birds are not uncommon in fall and winter, the fulmar grays apparently not being very resistant. No. 9983 C. A. S., dark phase, is somewhat albinistic, having a large irregular white patch on the posterior portion of the crown.

Many specimens, at least, have a series of distinct striæ on the inner side of the upper mandible.

In the following table are given the dimensions in millimeters of two hundred and thirty-two Pacific specimens, eighty males and one hundred and fifty-two females.

	Sex	Wing	Tail	Culmen	Upper Mandible		Tarsus	Middle Toe and Claw
					Depth	Width		
Maximum	♂	323	124	40.7	14.4	20.5	51.8	71
Minimum	♂	285	106	34.6	11.8	15.3	43	58
Mean	♂	307	114	37.8	13	17.5	46.5	63.5
Maximum	♀	322	122	40	13.8	18.6	48	67.2
Minimum	♀	280	99	32.5	10.5	14.1	39.5	52.1
Mean	♀	302	112	36	12.2	16.5	43.8	61.1

Inasmuch as the females average smaller than the males, it is obvious that Mr. Anthony in proposing *"Fulmarus glacialis columba,"* based on the dimensions of six females, mistook sexual variation for geographic variation.[1]

Forty typical examples of the two phases show the following measurements in millimeters.

Light phase: Ten males; wing 299-322 (314); tail 113-122 (117); culmen 36-40.6 (38.6); depth of upper mandible 12.2-

[1] Cf. Auk, v. 12, p. 107.

14 (13.3); width of upper mandible 16-18.9 (17.4); tarsus 46.6-51.8 (48.8); middle toe and claw 60.2-71 (65.7).

Dark phase: Ten males; wing 293-319 (306); tail 106-121 (113); culmen 36.1-39.7 (38.4); depth of upper mandible 12.2-14.1 (13.1); width of upper mandible 15.5-18.7 (17.2); tarsus 43-49 (45); middle toe and claw 58-68.1 (63.7).

Light phase: Ten females; wing 304-318 (312); tail 107-122 (116); culmen 34.6-39.1 (36.5); depth of upper mandible 11.8-13.8 (12.6); width of upper mandible 15.8-18.6 (17); tarsus 44-46.7 (45.3); middle toe and claw 61.4-64 (62.6).

Dark phase: Ten females; wing 288-312 (301); tail 107-116 (112); culmen 34.9-37.8 (36); depth of upper mandible 11-13.6 (12.2); width of upper mandible 14.9-17 (15.9); tarsus 41.2-46 (43.1); middle toe and claw 58-65 (61.7).

As shown in the foregoing measurements, the dark phase averages somewhat smaller than the light phase.

Priocella antarctica (*Stephens*): Slender-billed Fulmar

Coues—*Thalassoica glacialoides*, III, 30, V, 192.
Salvin—*Priocella glacialoides*, 393.
Godman—*Priocella glacialoides*, xliii, 165, pl. 43.

In their monographs Mr. Salvin and Dr. Godman treat *Fulmarus antarcticus* Stephens and *Procellaria glacialoides* A. Smith as being synonymous, but they ignore the priority of the former name over the latter one.

Audubon's account shows that Dr. Townsend, so far as positively known, captured but a single specimen of the Slender-billed Fulmar off the Oregon coast, and that the manuscript note appended to this specimen applied also to the Fulmar.[1] "Within a day's sail from the mouth of the Columbia River," is given as the position where the specimen of the Slender-billed Fulmar was taken. Several years ago I examined this specimen at the United States National Museum along with other Townsend Tubinares preserved in that institution.

Mr. Cassin, in his Wilkes Expedition report, makes the following statement: "The only specimen in the collection of the

[1] Cf. Orn. Biog., v. 5, pp. 331, 333.

Expedition is labelled as having been obtained on the coast of Oregon."[1] Concerning the status of this specimen in the United States National Museum, Dr. Richmond writes me as follows: "There is one *Priocella glacialoides* recorded from Oregon, No. 15707 (ex U. S. Expl. Exped.), but I cannot find the specimen in our skin series. It may have been sent away years ago—possibly to the Boston Soc. of Nat. History. We sent between 200 and 300 Exploring Exped. specimens to that Society in the '60s, but I have not been able yet to find a record of the individual specimens. We have, of course, Audubon's type of *Proc. tenuirostris* (U. S. N. M. No. 2032)."

In his monograph, Mr. Salvin lists a specimen from "Mazatlan, Coast of Mexico."[2]

Dr. Cooper, as reported by Dr. Brewer, does not make it clear that he ever met with this species off the coast of California.[3]

Petrella capensis (*Linnæus*): Cape Petrel; Pintado Petrel

Coues—*Daption capensis,* IV, 162, 171.
Salvin—*Daption capensis,* 428.
Godman—*Daption capensis,* I, 276, pl. 80.

Petrella Zimmermann ex Bartram apparently supersedes *Daption* Stephens.[4]

Colonel Pike's specimen from "the coast of California, opposite Monterey,"[5] formerly in the collection of Mr. George N. Lawrence and now No. 45965 in the American Museum of Natural History apparently represents the most northerly occurrence on record for the eastern side of the Pacific.

Dr. Frederic A. Lucas, in an article entitled *Notes of a Bird Catcher,* says: "On the Pacific coast it seems to range much farther north, for in July we left them outside the harbor of Valparaiso, and in September they were common in latitude 11° south. Captain Carey, of the ship 'Calhoun,' informed me that a few followed that vessel nearly to Acapulco, 16° N."[6]

[1] U. S. Expl. Exp., 1858, p. 410.
[2] P. 394.
[3] Cf. Water Birds N. A., v. 2, pp. 374, 384.
[4] Mathews, Auk, 1914, pp. 88, 90, 91; Richmond, Proc. U. S. Nat. Mus., 1917, v. 53, p. 614.
[5] Ann. Lyc. N. H. N. Y., v. 6, p. 7.
[6] Auk, v. 4, p. 4.

Thorough work in the more southerly portions of the ocean area we are considering would probably develop "Cape Pigeons" in considerable numbers after their breeding season.

The color variations of this species are perhaps largely dichromatic, the dark-throated and dark-mantled birds representing a dark phase and the pied-throated and pied-mantled birds a light phase.

Pterodroma longirostris (*Stejneger*): Stejneger's Petrel

Salvin—*Œstrelata longirostris*, 418.
Godman—*Œstrelata longirostris*, xlv, 250.

My identification of the specimens mentioned below is provisional; for I have yet to examine the type of *Æstrelata longirostris* Stejneger and a series of *Procellaria leucoptera* Gould from the type locality.

This petrel, heretofore known only from Asiatic seas, was one of the finds of the Expedition. It was not encountered until the home voyage was nearly over, when five specimens were captured by Mr. R. H. Beck—a male on the 14th of November in latitude 33° 6′ N. and longitude 134° W. and two females and two males on the 19th of November in latitude 35° 40′ N. and longitude 133° 10′ and 14′ W. In his notes, Mr. Gifford reports having seen one each day on the 15th, 16th, and 18th.

Stejneger's Petrel may prove to be an interhemisphere migrant, breeding south of the Equator and visiting the North Pacific during the exodus-migration.

The five specimens are having a renewal that does not include the primaries. These flight-feathers show but little wear, conveying the impression that a limited prenuptial moult is in progress.

Mr. Gifford states in his notes that the unfeathered parts in life had the following colors: "Bill black; iris dark brown; orbital ring black; tarsus flax flower blue; inner toes same color on upper side, with black joints; outer toe and under side of middle one black; webs whitish with dark streakings."

MEASUREMENTS (in millimeters)

No.	Sex	Length	Extent	Wing	Tail	Culmen	Upper Mandible		Tarsus	Middle Toe and Claw
							Depth	Width		
1143	♂	.....	.....	211	89	24.6	6.8	8.8	25.4	34.8
1144	♂	.....	.....	214	89	24.5	7	8.8	26.3	34.3
1145	♂	.....	.....	213	99	25.1	7	9.5	26.9	33.9
1141	♀	292	698.5	215	96	24.8	7.1	9	25	34.1
1142	♀	.....	.....	214	92	25.7	7.1	9.3	26.8	34.3

Pterodroma brevipes (*Peale*): Short-footed Petrel

Coues—*Æstrelata Cookii*, IV, 152, 154, 170, in part; *Æstrelata desolata*, IV, 155, 171, in part.
Salvin—*Œstrelata brevipes*, 398, 408.
Godman—*Œstrelata brevipes*, xlv, xlvi, 209, pl. 57.

Three males and five females of the light phase were shot by Mr. R. H. Beck on June 11, 1906, in latitude 4° 20′ S., longitude 93° 30′ W., a position almost directly north of the type locality in the Antarctic, latitude 68° S., longitude 95° W.

The known range of the species is extended by these captures to the Eastern Pacific. Further observation may disclose that its exodus-migration is a southward one, extending from the Torrid to the South Frigid Zone.

In his notes, Mr. Gifford states that these gadfly petrels were common on June 11, as many as fifteen birds being observed in a single flock; that one was seen on the 12th, and none afterwards.

I have compared two representative specimens of the Expedition series with the type (No. 15459 U. S. Nat. Mus.) and find that they agree with it in all essential particulars.

There is but little variation in the eight Expedition specimens. Four have the whole of the inner web of the outer tail feather pure white; the others have the terminal half of it more or less freckled with gray. In some the black of the head and hind neck shows a tendency to invade the gray of the back. A complete moult is well under way in all.

"Colors of naked parts: Bill black; iris dark brown; orbital ring black; skin in interramal space whitish, with dark stripes; tarsus and basal portion of inner toes and webs bluish white, remaining portion and entire outer toe dusky" (*Gifford*).

MEASUREMENTS (in millimeters)

No.	Sex	Length	Extent	Wing	Tail	Culmen	Upper Mandible		Tarsus	Middle Toe and Claw
							Depth	Width		
1111	♂	.....	.....	234	97	25	7.9	10	27	39.1
1113	♂	.....	.....	230	95	27	8.5	11.6	27.4	37.5
1115	♂	305	.....	231	93	24.3	8	11.4	27	36.8
1109	♀	320	.....	.....	96	25.9	8.4	11.5	28.6	38.9
1110	♀	305	760	231	94	25.1	8.1	11	27.3	35.2
1112	♀	.....	.....	225	97	24.5	8.1	11	27.7	38.5
1114	♀	305	740	227	94	26.2	9	12	28	39.1
1116	♀	320	755	231	96	26	8.5	11.6	28	38

Pterodroma cooki (*Gray*): Cook's Petrel

Salvin—*Œstrelata cooki*, 399, 417; *Œstrelata defilippiana*, 399, 417.
Godman—*Œstrelata cooki*, xlv, 247, pl. 71; *Œstrelata defilippiana*, xlv, 245, pl. 70.

Cook's Petrels were common during the afternoon of July 22, 1905, in latitude 22° 25′ N., longitude 112° 40′ W. The *Academy* was becalmed at the time and they were attracted to its vicinity by a school of small fish. Mr. R. H. Beck shot nineteen, of which eleven were skinned and five preserved in alcohol. During the next two days there was a strong north-easterly wind and a single individual only was noted. On the 25th another was seen, the last one for the entire voyage.

This petrel is apparently a Southern Hemisphere species that has an exodus-migration that extends north of the Equator.

Aestrelata defilippiana Giglioli & Salvadori appears to be merely a synonym, for no constant differences are found that separate Eastern from Western Pacific birds. In most of the Expedition specimens the dark marking at the eyes is more prominent than in two New Zealand ones (No. 24341 Carnegie Mus.; No. 109193 U. S. Nat. Mus.). Dr. Godman's statement that the general color is paler and the bill shorter and stouter[1] in Eastern Pacific examples is not sustained in the material before me. As these petrels darken with wear, much stress should not be placed on superficial tones unless the birds are in fine feather.

All the Expedition specimens are passing through a complete moult, donning apparently a post-breeding garb.

[1] Mon. Petrels, p. xlv.

MEASUREMENTS (in millimeters)

No.	Sex	Length	Extent	Wing	Tail	Culmen	Upper Mandible		Tarsus	Middle Toe and Claw
							Depth	Width		
1146	♂	.....	.....	.....	87	27	7.6	11.3	28.5	37.2
1148	♂	315	735	.....	91	28	7.8	10.1	28.9	39.5
1149	♂	310	720	.....	92	27.5	8	10.5	29.5	38.3
1151	♂	320	690	.....	90	28.8	7.9	10	29	38.9
1152	♂	.....	.....	.....	90	27	8	10.6	27.7	39
1155	♂	.....	.....	.....	97	28.3	7.9	10.7	29.2	39.2
24341 [1]	♂	.....	.....	237	92	27	8	9.8	28.5	37
1147	♀	.....	.....	.....	93	28.5	7.4	9.6	29	40
1150	♀	315	698	.....	91	27.4	7.9	9.7	27.8	38.9
1153	♀	.....	.....	.....	90	27.4	7.4	9.4	28.4	39
1154	♀	.....	.....	234 [3]	92	27.4	7.9	10.4	27.3	37
1156	♀	.....	.....	.....	94	27.4	7.8	11	28	40.4
109193 [2]	♀	.....	.....	234	90	28.1	7.3	9.7	30	39.5

Pterodroma externa (*Salvin*): Juan Fernandez Petrel

Salvin—*Œstrelata externa*, 398, 411.
Godman—*Œstrelata externa*, xliv, 221, pl. 62.

Fifteen specimens were shot by Mr. R. H. Beck; a male on August 8, 1905, twenty miles northwest of Clipperton Island, and nine males and five females on the 4th and 5th of October, 1906, in latitude 14° 24′ to 14° 28′ N. and longitude 107° to 107° 5′ W.

Like numerous other petrels breeding in the South Temperate Zone, this species apparently extends its exodus-migration beyond the limits of the Southern Hemisphere.

In unworn plumage, the feathers of the upper parts are washed as well as edged with gray; the wings, too, are more or less washed with gray, and extensively edged with grayish white. In one of the males the top of the head is ornamented with numerous silvery white filoplumes.

In the August specimen a complete moult is well under way and in twelve of the October specimens it has reached the final stages. The two remaining October specimens (perhaps birds-of-the-year) are in somewhat worn plumage and show but little active feather growth. In several specimens a temporary white collar has been developed where loose feathers have fallen out exposing the basal white of the cervix.

[1] New Zealand; Carnegie Museum.
[2] New Zealand; U. S. National Museum.
[3] Distal primary not fully grown.

Mr. Gifford remarks in his notes that the bill and orbital ring are black, the iris dark brown, the lower parts of the feet black and the remaining parts pinkish white.

Six specimens of *Pterodroma cervicalis,* two of them emerging from the natal down, and the Expedition series of *Pterodroma externa* show the following differential characters:

P. externa	*P. cervicalis*
Cap dark brownish gray, fading into grayish brown in worn plumage.	Cap brownish black.
No definite cervical collar.	Definite cervical collar white, clouded with gray.
First primary extensively white on inner web.	First primary with little or no white on inner web.
Only indications of dark band on inner edge of wing.	Dark band, varied with white, on inner edge of wing.
Dark color of tail (except outermost web) brown, washed with gray in fresh plumage and forming definite tips to outer feathers.	Dark color of tail gray, not forming definite tips to outer feathers, and fading into grayish brown in worn plumage.
Shafts terminally black or dark brown in all the tail feathers.	Shafts not terminally black or dark brown in all the tail feathers.

MEASUREMENTS (in millimeters)

No.	Sex	Length	Extent	Wing	Tail	Culmen	Upper Mandible		Tarsus	Middle Toe and Claw
							Depth	Width		
1117	♂	470	1092	336	150	37.4	14	18	37.4	55.9
1118	♂	457	1074	328	146	38.4	12.9	17.1	36.1	54.8
1120	♂	435	1015	.....	146	39.9	13.7	17	36	50.5
1123	♂	444	1029	.....	138	36.9	12.9	17	33.1	49
1125	♂	.....	.....	316	133	38	13.4	18	35.7	52.1
1126	♂	.....	.....	313	138	.....	12.6	17.4	34.3	52.2
1127	♂	444	1054	320	134	39.1	12.8	17.7	37	50
1128	♂	437	1067	314	145	37	14.2	19	37.6	50.6
1129	♂	432	1041	309	139	36.5	12.7	17.1	37	53.9
1130	♂	457	1054	327	145	39.1	13.8	18.5	35	51
1119	♀	449	1067	320	138	38.3	13.4	18.1	37	52.2
1121	♀	439	1067	316	132	37.5	12.9	16.1	36.1	53
1122	♀	444	1054	323	135	36.2	12.3	15.5	33.4	47.7
1124	♀	.....	.....	.....	134	39	12.8	16.8	35.9	49.8
1131	♀	432	1041	313	138	35.3	12.9	16.4	34.6	50

Pterodroma phæopygia (*Salvin*): Dark-rumped Petrel

Salvin—*Œstrelata phæopygia*, 398, 407.
Godman—*Œstrelata phæopygia*, xlvi, 207, pl. 56.

From Mr. Gifford's notes it appears that Dark-rumped Petrels were first met with by the Expedition on July 31, 1905, in latitude 14° N., longitude 110° W. Early in the morning the vessel sailed by a large flock of birds, composed chiefly of these petrels, Wedge-tailed Shearwaters, and Noddies. At midday a similar flock was encountered. On August 1, latitude 13° 28′ N., longitude 108° 52′ W., three males and three females were taken. During the cruise south of latitude 14° N. Dark-rumped Petrels were prominent in the bird life of the sea, occurring from the vicinity of Clipperton Island, eastward to within a few miles of the Ecuador coast, and southward to latitude 4° 25′ S., longitude 93° 30′ W., the most southerly position attained by the Expedition. On the voyage north the last Dark-rumped Petrel was seen September 29, 1906, in latitude 9° 22′ N., longitude 98° 25′ W.

Whether the great stretch of ocean between Clipperton Island and the Hawaiian Archipelago is frequented by these petrels is not definitely known. It may be that the Hawaiian birds are isolated at all seasons from the birds occurring off the American coast.

Mr. Gifford's Galapagos notes are condensed in the following paragraphs:

Dark-rumped Petrels were present during the entire year in the archipelago. They were inclined to shun the quiet bays and coves and frequent the open sea. At times they were very common. The largest gatherings were seen off Iguana Cove, Albemarle Island, in April and off Indefatigable Island in July. They breed on Indefatigable Island in the humid uplands—a foggy zone of forests and dense undergrowth. Similar situations on James and Albemarle islands are probably inhabited by breeding colonies. Protracted rainy weather, dense vegetation requiring the constant use of the machete, and lack of time prevented a thorough exploration of their breeding haunts. Nevertheless, Mr. Beck succeeded in securing a male and a fresh egg on July 22, 1906, from a burrow in the forest on the northwestern side of Indefatigable Island at an elevation of

eleven hundred feet. The burrow had been driven through the fern and vine roots, that reinforced the soil, to the length of about four feet, where it terminated, fourteen inches below the surface, in a chamber lined with dry leaves.

An egg, ready to be deposited, was taken from the oviduct of a bird shot on June 7 at sea about forty miles south of Albemarle Island. In April, off Iguana Cove, specimens were obtained showing considerable enlargement of the reproductive organs.

During the breeding season they were active over the land at night. A party from the *Academy* in camp near the summit of James Island on August 7 were kept awake by their incessant call-notes, uttered as the birds flew about just above the tree tops. At Indefatigable Island they congregated close inshore at dusk and circled over the water in loose flocks, from which individuals were constantly ascending in great spirals to the height of several hundred feet, when they headed inland. In the interior of the island they were particularly prominent during two hours after sunset and during two hours before sunrise, there being an evening flight to the land and a morning flight away from it. While members of the Expedition were in the forest belt of Indefatigable Island in November, these petrels were frequently seen and heard in the nighttime as they flew overhead, but in January none were met with on the island, the land apparently having been forsaken for the sea.

Usually their call-notes consist of four parts, "kee-kee-kee-koo," the first three uttered quickly and the last drawn out. Sometimes the order is reversed and sometimes the "koo" is omitted. Occasionally the call-notes were heard in the daytime. A low guttural note was detected on one occasion when several hundred of these birds were following the vessel picking up the turtle fat that had been thrown overboard. These petrels were very fond of this fat and it was used to decoy them within gunshot. Remains of pteropods and cœlenterates were found in their stomachs.

At sea their manner of flying did not differ from that of other representatives of the genus met with on the Expedition. In dead calms they flew near the surface of the water, and two or three wing strokes were succeeded by a sailing flight of a

hundred feet or more. One September day when a strong wind was blowing several were seen "sweeping along in great arcs, seldom flapping their wings." In flying over the land to their breeding grounds, they flap their wings continually, but in returning to the water they change their mode of flight, two or three wing beats being followed by a long sail.

The fact is worthy of record that a small centipede, belonging to a species inhabiting the humid belts of the Galapagos Islands, was found among the feathers of a Dark-rumped Petrel taken in latitude 3° 9′ S., longitude 91° 41′ W.[1]

In the fresh plumage of both sexes, the feathers of the back and scapulars have a more or less grayish aspect, and are tipped in a varying degree with grayish white or light gray. Fading and wearing off of the tips of the feathers produce a uniform dark aspect quite different from the fresh plumage, at first glance suggesting a double form of coloration. The dark cap, so characteristic of some of the *Pterodromæ,* is not wanting in the present species. It is especially conspicuous in birds in new attire. In certain specimens (notably No. 932 C. A. S.) the upper tail-coverts are tipped with grayish white. The greater and middle wing-coverts in some instances are more or less washed with ash-color and edged with grayish white (e. g. No. 970 C. A. S.). In a male (No. 947 C. A. S., June 18, 1906) the dark color of the sides of the neck is extended across the jugulum in irregular transverse bars of gray, forming a band about an inch and a fourth in width. The sides are heavily barred with gray, becoming nearly uniform on the flanks; the back, too, appears to be exceptionally dark. The jugular and lateral markings occur in a lesser degree in numerous other Expedition specimens of both sexes, obtained at various times of the year. Whether dichromatism, age, or individual variation is illustrated in these peculiarities is not made clear in the Academy's series. The under tail-coverts in some cases have indications of gray mottling. The white on the inner web of the primaries varies in extent; for example, on the first primary in No. 937 C. A. S., male, July 18, 1906, it is concealed, while on the first primary in No. 1027 C. A. S., male, June 11, 1906, it extends for an inch and three

[1] Cf. Bryan, Occ. Papers B. P. B. Mus., v. 2, no. 1, p. 109; Dill, Bull. No. 42 Biol. Surv., U. S. Dept. Agric., p. 11; Wallace, Island Life, p. 246, footnote; Hyatt and Pilsbry, Manual of Conchology, 2nd ser., pp. xiv, xv.

eighths beyond the under primary-coverts. No. 956 C. A. S., male, June 16, 1906, has numerous grayish white filoplumes on the occiput and posterior portion of the crown. A few other specimens are similarly, but more sparsely, adorned. A redundancy of rectrices occurs in Nos. 1003 and 1004 C. A. S., the former having thirteen rectrices and the latter fourteen.

The life colors of the naked parts are described by Mr. Gifford as follows: "Bill black; iris dark brown; orbital ring black; skin in interramal space flesh-colored; tarsus pinkish white; toes and webs black, basally pinkish white."

The Expedition series of one hundred and eighty-one specimens is distributed as follows: January, nine specimens; April, thirty-seven; May, thirty-six; June, forty; July, twelve; August, eleven; September, four; October, thirty-two.

Judging from the specimens at my disposition, the postnuptial moult in the Galapagos birds generally begins in October and ends before April. The thirty-seven April specimens (secured in 1906 on the 23rd and 24th) show signs of abrasion, manifesting that destructive changes have begun. May, June, and July specimens (procured in 1906) and September ones (procured in 1905) display increasing wear. In some May individuals considerable renewal is taking place. The thirty-two October specimens (all taken on the 14th in 1905) are in worn livery. Most of them are beginning to renew the feathers of the breast. In many the replacement is also commencing on the back and in some on the head. The nine January birds (all shot before the end of the first week in 1906) have suffered much from wear and tear. In the majority, the innermost primaries are being moulted along with the head, neck, and body plumage, indicating a later stage in the restoration. In the eleven August specimens (obtained in 1905 between the 1st and 8th of the month at sea in latitude 13° and 10° N.) the renewal is more advanced, involving, in some cases at least, both primaries and rectrices. As the specimens taken in the immediate vicinity of the archipelago exhibit a different cycle in moulting, it may be that these August birds hail from other breeding stations than the Galapagos Islands. However, the possibility is not lost sight of that they may be young of the previous year undergoing

a deferred postjuvenal moult. Unfortunately, the state of the generative organs is not recorded on the labels.

Mr. William Alanson Bryan has revived[1] *Œstrelata sandwichensis* Ridgway, maintaining that eight males and twelve females from Molokai Island have dimensions and color characters which separate them specifically from birds from the Galapagos Islands. Through the courtesy of the Board of Directors of the Bernice Pauahi Bishop Museum, I am able to compare the Molokai specimens with those of the Expedition, and to test the value of the assumed specific characters.

In order that the personal factor in the measurements may be maintained, Mr. Gifford has remeasured the Molokai specimens and the results, in millimeters, are summarized in the following table:

	Sex	Wing	Tail	Culmen	Upper Mandible		Tarsus	Middle Toe and Claw
					Depth	Width		
Maximum	♂	286	142	32.1	12	15.9	36.3	50
Minimum	♂	280	122	29	11	13.8	32.3	45.3
Mean	♂	283	133	31.1	11.5	14.8	34.5	47
Maximum	♀	292	138	32.1	11.4	15.9	35.5	48
Minimum	♀	274	127	29.5	10.3	13	33	42
Mean	♀	283	132	30.8	11	14.4	34.2	46.2

Comparison with the measurements of the Expedition specimens, given beyond, shows that the maximum dimensions of the Molokai overlap the minimum dimensions of the Expedition specimens, demonstrating that size in the present instance is not a constant character and therefore not of specific significance. The supposed color characters are also illusive. One of the Molokai specimens (No. 4677 B. P. B. Mus.) exhibits considerable gray on the axillaries and the wide immaculate frontal band occurs in some of the Expedition birds. The outer rectrices are fairly matched in certain examples of the two series. The feathers of the back and scapular region are worn in the Molokai specimens, and hence do not afford a good basis of comparison. It is apparent that the evidence does not sustain the contention that the Hawaiian Dark-rumped Petrels are specifically distinct from the Galapagos Dark-rumped Petrels.

[1] Occ. Papers B. P. B. Mus., 1908, v. 4, No. 2, pp. 52, 53.

Below are tabulated the measurements in millimeters of one hundred and sixty-six Expedition specimens, ninety-eight males and sixty-eight females.

	Sex	Wing	Tail	Culmen	Upper Mandible		Tarsus	Middle Toe and Claw
					Depth	Width		
Maximum	♂	323	155	35.6	12.8	16.4	38.7	54
Minimum	♂	291	126	31	10.8	13.5	33.1	48
Mean	♂	306	142	33.6	11.9	14.9	35.5	50.6
Maximum	♀	316	150	35.9	12.4	15.5	37.4	53
Minimum	♀	287	130	31	10.6	13	32.5	46.8
Mean	♀	305	140	33.3	11.5	14.4	35.3	50

Length in flesh: Twenty-four males, 395 - 425 mm. (412); twenty-two females, 390 - 425 mm. (407.5).

Extent: Seventeen males, 100 - 105 cm. (102.2); thirteen females, 98 - 108 cm. (102.1).

It will be seen from the above measurements that the females do not differ materially in size from the males.

The two eggs referred to above are dull white; the one taken from the oviduct is ovate in form, and the other elliptical ovate. They measure respectively: 61.4 x 44.1 mm. and 61.5 x 39 mm. Heretofore the egg of this species appears to have been undescribed.

Pterodroma neglecta (*Schlegel*): NEGLECTED PETREL

COUES—*Æstrelata neglecta*, IV, 147, 170.

SALVIN—*Œstrelata neglecta*, 399, 412; (?) *Œstrelata arminjoniana*, 399, 413; (?) *Œstrelata trinitatis*, 399, 413; (?) *Œstrelata heraldica*, 399, 414.

GODMAN—*Œstrelata neglecta*, xlvii, 226, pl. 64; (?) *Œstrelata arminjoniana*, xlvii, 229, pl. 65; (?) *Œstrelata trinitatis*, xlviii, 232, pl. 66; (?) *Œstrelata heraldica*, xlvii, 234, pl. 67.

Aestrelata trinitatis Giglioli & Salvadori, *Aestrelata arminjoniana* Giglioli & Salvadori, and *Œstrelata heraldica* Salvin are included in the above synonymy with a query, for their specific distinctness from *Pterodroma neglecta* has not been satisfactorily established.[1]

From the description and plate, I infer that *Æstrelata chionophara* Murphy[2] is merely an albinistic example of *"Aestrelata arminjoniana."*

[1] Cf. Iredale, Ibis, 1914, p. 435, and keys and descriptions in monographs of Salvin and Godman.

[2] Auk, 1914, v. 31, p. 13, pl. 2.

During the homeward voyage of the *Academy* a male and a female of the light phase of the Neglected Petrel were taken by Mr. Beck, the former on October 4, 1906, in latitude 14° 24′ N., longitude 107° 5′ W., and the latter on October 12, 1906, in latitude 15° 40′ N., longitude 110° 12′ W. According to Mr. Gifford's notes, individuals of the dark phase were occasionally seen during the homeward voyage in latitude 7° to 15° N.

This petrel apparently belongs to the class of Southern Hemisphere petrels that regularly cross the Equator in the exodus-migration.

Both of the specimens mentioned above are having a complete renovation of plumage. It is much more advanced, however, in the male than in the female.

In a white-headed example from Sunday Island (No. 24336 Carnegie Mus.) the brown of the under wing-coverts is largely dominated by white and in the Expedition female the white of the lower tail-coverts is much extended, the exposed brown prevailing only at the tips of the longer feathers.

MEASUREMENTS (in millimeters)

No.	Locality	Phase	Sex	Wing	Tail	Culmen	Upper Mandible		Tarsus	Middle Toe and Claw
							Depth	Width		
24336 [1]	Sunday Island	Light	..	286	102	31.3	11.3	13.7	36.5	52.4
1132	14°24′ N., 107°5′ W.	do.	♂	293	106	30	11	14	35	50
1133	15°40′ N., 110°12′ W.	do.	♀	283	104	30.9	10.3	13.2	32.9	50.7
24337 [1]	Sunday Island	do.	..	300	102	29	10.9	13.4	36	51.7
174638 [2]	Herald Islet	do.	♂	295	104	32.5	11.9	14.7	38	50.3
24331 [1]	Kermadec Islands	do.	..	301	107	30.5	10.8	14.7	38.8	53
24334 [1]	Sunday Island	Intermediate	♂	295	103	28.8	9.5	14.5	36.1	50.5
24332 [1]	Kermadec Islands	do.	..	298	104	30.3	11.4	15.3	37	54.1
124672 [2]	Sunday Island	do.	..	281	101	30.9	10.8	14	38	53.8
24335 [1]	Sunday Island	do.	♂	288	101	29.1	10	14.3	37.5	52.3
24333 [1]	Kermadec Islands	Dark	..	296	106	31.9	12	14.4	37	53.4
24338 [1]	Sunday Island	do.	..	286	100	31.7	11.7	14.7	38.2	55.7
124676 [2]	Sunday Island	do.	..	303	104	29	11	14.1	37.2	49

[1] Carnegie Museum.
[2] U. S. National Museum.

Pterodroma parvirostris (*Peale*): Small-billed Petrel

Coues—*Æstrelata parvirostris*, IV, 146, 170.
Salvin—*Œstrelata parvirostris*, 398, 405.
Godman—*Œstrelata parvirostris*, xlvi, 193, pl. 52; *Œstrelata wortheni*, xlvi, 205.

Dr. Godman's detailed description of the type of *Œstrelata wortheni* Rothschild tallies so well with two specimens of *P. parvirostris* from Christmas Island (Nos. 67317 and 67331 U. S. Nat. Mus.) that I am constrained to place *"Œ. wortheni"* in the synonymy of *P. parvirostris*. Singularly, Dr. Godman's description of *P. parvirostris* agrees rather closely with his description of *"Œ. wortheni."*[1]

The type of *"Œ. wortheni"* was taken in latitude 3° S., longitude 118° 45′ W. on January 2, 1901, by Mr. R. H. Beck.[2] I know of no other instance of the occurrence of the present species in the sea area under consideration.

No. 67317 U. S. Nat. Mus.: Wing 282 mm.; tail 111; culmen 28; depth of upper mandible 10; width of upper mandible 12.5; tarsus 32.1; middle toe and claw 45.5.

No. 67331 U. S. Nat. Mus.: Wing 285 mm.; tail 112; culmen 28; depth of upper mandible 10; width of upper mandible 12.1; tarsus 32.5; middle toe and claw 46.

Pterodroma inexpectata (*J. R. Forster*): Mottled Petrel

Coues—[*Æstrelata gularis*], IV, 150, 151.
Salvin—*Œstrelata gularis*, 399, 414; *Œstrelata fisheri*, 415; *Œstrelata scalaris*, 416.
Godman—*Œstrelata gularis*, xlv, 236, pl. 68; *Œstrelata fisheri*, xlv, 239; *Œstrelata scalaris*, xlv, 241.

In the run northwards, Mr. R. H. Beck shot four males and three females on November 19, 1906, in latitude 35° 40′ N., longitude 133° 10′ and 14′ W. Mr. Gifford states in his notes that five or six were seen on the 18th of November, one or two on the 20th, two on the 21st, two or three on the 22nd, one or two on the 23rd, three or four on the 24th, one or two on the 25th, and finally one on the 26th in latitude 36° 43′ N. and longitude 129° 31′ W. He describes the flight as rapid and erratic.

[1] Mon. Petrels, pp. 194, 205.
[2] Bull. Brit. Orn. Club, v. 12, p. 63.

The Mottled Petrel is a wide-ranging species, breeding in the Southern Hemisphere and visiting the Northern Hemisphere after the period of reproduction.

There is considerable variation in the extent of the white and in the aspect of the gray in the seven Expedition specimens. In No. 1135 the white extends from the bill almost to the abdomen, while in No. 1136 it ends on the anterior part of the breast and is much obscured by gray, the chin and throat alone being immaculate. In the whole series there is an intrusion of gray on the lower tail-coverts, very slight, however, in No. 1134. The extremes in the gray coloration are represented in No. 1139 and No. 1134; the former is slate-gray above and dark mouse gray below and the latter gray above and mouse gray below. The ashy white tips of the feathers of the upper parts have suffered more or less from wear in all the specimens of the series. No. 1138 has thirteen rectrices.

A male from the collection of Dr. Leonard C. Sanford, taken near Kiska Island, Alaska, June 17, 1911, by Mr. R. H. Beck, is undergoing a complete moult, which is apparently about over on the body. The worn outer primaries still remain, but the inner ones are being replaced. Six of the Expedition specimens show some feather replacement; in several it involves the tail. According to Mr. Gifford, the sexual organs were small in the seven Expedition birds.

Mr. Gifford reports the colors of the unfeathered parts as follows: "Bill and orbital ring black; iris dark brown; tarsus and base of toes and webs very light bluish; remaining portions of webs and toes black. One specimen had tarsi, toes, and webs all black."

Procellaria gularis Peale is apparently a synonym of *Procellaria inexpectata* J. R. Forster, for Forster's description covers well the essential characters of Peale's type (No. 15706 U. S. Nat. Mus.) and antedates Peale's description.[1] *Pterodroma inexpectata,* therefore, appears to be the proper name of this species. Although aware of the priority of *inexpectata,* Mr. Salvin and Dr. Godman preferred to use in their monographs the later specific name, *gularis.*

[1] Cf. Forster, Descr. Anim., 1844, pp. 204, 205; Peale, U. S. Expl. Exp., 1848, p. 299.

Besides the type of *"Procellaria gularis,"* I have examined the type of *Œstrelata fisheri* Ridgway (No. 89431 U. S. Nat. Mus.) and that of *Æstrelata scalaris* Brewster (No. 5224 Coll. W. Brewster). The type of *"Œstrelata fisheri"* is a worn, faded, and rather weak-billed example of *Pterodroma inexpectata.* The white-headed aspect is caused chiefly by wear and accidental loss of feathers, exposing the white bases. The feathers of the upper parts of the body are much worn, accounting for the absence of the whitish margins characteristic of the fresh plumage of *Pterodroma inexpectata.* The weak appearance of the bill is largely due to mutilation, the basal portion of the unguis having been torn off and the nasal tubes flattened. The color above is darker than in No. 1134 and lighter than in No. 1139 of the Expedition collection. The markings of the pileum and nape and the extension of the white of the rectrices, greater wing-coverts, and secondaries break down through an intermediate New Zealand specimen (No. 24345 Carnegie Mus.). The type of *"Æstrelata scalaris"* is merely a bird in fresher plumage than the other types. The supposed differences in the nasal tubes do not exceed the normal variation occurring in *Pterodroma inexpectata.*

MEASUREMENTS (in millimeters)

No.	Locality	Sex	Wing	Tail	Culmen	Upper Mandible		Tarsus	Middle Toe and Claw
						Depth	Width		
1134	35° 40′ N., 133° 10′ W.	♂	260	95	25.9	9.3	11	31.4	46
1136	35° 40′ N., 133° 14′ W.	♂	259	105	26.5	8.8	11.4	30.5	41.2
1137	35° 40′ N., 133° 10′ W.	♂	254	105	26.2	9.5	11.5	30.4	42.5
1138	do.	♂	261	102	26.5	9.7	11.5	30.1	42.5
224[1]	Preservation Inlet, N. Z.	♂	256	97	27.9	9.7	12	31.9	44.8
226[1]	do.	♂	250	101	27	9.9	11.6	33	43.1
228[1]	do.	♂	260	103	26.1	9.9	11.5	31.2	43.5
14222[1]	do.	♂	257	104	26	9.5	12.5	32	42.6
14224[1]	do.	♂	256	100	28.1	10	13.5	33.5	44.8
14225[1]	do.	♂	259	102	26.8	9.7	12.2	32.5	46.7
24343[2]	Auckland Isd.	♂	258	102	27	10.4	12.7	35	46.4
24345[2]	Otago Coast	♂	247	100	28	10	11.5	31.8	42.3
9674[3]	Preservation Inlet, N. Z.	♂	255	103	27.4	10	12.2	35	44.9
....[4]	Off Kiska I., Alaska	♂	267	105	26.6	9.5	11.6	33.5	45
....[4]	Preservation Inlet, N. Z.	♂	247	102	25.9	9.3	11.2	30.7	42.5
151109[5]	Snares Isl.	♂	259	107	27	10	11.4	32.5	40.7
1135	35° 40′ N., 133° 10′ W.	♀	257	100	27.1	9.1	11	30.1	42.2
1139	do.	♀	259	97	27.1	9.4	12.7	31.2	46
1140	35° 40′ N., 133° 14′ W.	♀	244	96	27.8	9	11	31	42.7
225[1]	Preservation Inlet, N. Z.	♀	257	104	26.1	9.2	11.9	31	42.7
227[1]	do.	♀	258	102	27	9.6	11.9	32.2	43
229[1]	do.	♀	259	97	27.5	9.7	12.5	35	47
14227[1]	Preservation Inlet, N. Z.	♀	254	97	26.5	9.9	11.2	33.9	42.8
24344[2]	Auckland Isd.	♀	248	99	28.4	10.2	12.5	32.1	43
1802[3]	Preservation Inlet, N. Z.	♀	253	96	26.2	9	11.5	32	41.2
....[4]	do.	♀	252	97	26.3	9	11.6	31.9	41.3
89431[6]	St. Paul, Kodiak Id., Alaska	♂	256	98	27.9	9	11.7	32.9	43

Length in flesh.—No. 1134; 343 mm.: No. 1137; 349 mm.: No. 1138; 343 mm.: No. 1135; 343 mm.: No. 1139; 353 mm.

Extent.—No. 1134; 819 mm.: No. 1137; 825 mm.: No. 1138; 819 mm.: No. 1135; 838 mm.: No. 1139; 845 mm.

[1] Coll. John E. Thayer.
[2] Carnegie Museum.
[3] Coll. Outram Bangs.
[4] Coll. L. C. Sanford.
[5] U. S. National Museum.
[6] Type of *"Œstrelata fisheri;"* U. S. National Museum.

Procellaria parkinsoni *Gray:* PARKINSON'S PETREL

COUES—[*Majaqueus Parkinsoni*], IV, 157, V, 192.
SALVIN—*Majaqueus parkinsoni,* 395, 397, pl. 5.
GODMAN—*Majaqueus parkinsoni,* xliv, 174, pl. 45.

Among the surprises of the Expedition was the discovery in Galapagos waters of Parkinson's Petrel, a species supposed to be peculiar to New Zealand and Australian seas. Three specimens were shot by Mr. R. H. Beck—a female, October 14, 1905, five miles north of Chatham Island; a male, May 4, 1906, near Charles Island; a male, June 18, 1906, latitude 2° 40′ S., longitude 91° 20′ W.

A complete renewal of plumage is in progress in the May and June specimens. The October specimen is in worn attire and is replacing the feathers of the head and body, perhaps undergoing a belated moult rather than a prenuptial one.

According to Mr. Gifford, the colors of the unfeathered parts are as follows: "Bill chiefly pale blue (covered in places with scaly straw yellow epidermis), black along sutures, on culmen between nasal tubes and unguis, and at tip; orbital ring black; iris dark brown; skin in interramal space dark brown; feet black, webs silver-veined."

MEASUREMENTS (in millimeters)

No.	Sex	Length	Extent	Wing	Tail	Culmen	Upper Mandible		Tarsus	Middle Toe and Claw
							Depth	Width		
925	♂	445	1190	.....	103	43.9	13	16.5	50.5	70
926	♂	.....	.....	345[1]	106	42.7	13.4	16.5	50	70
927	♀	430	1220	345	104	38.6	12.8	16.1	48.6	69.2

Priofinus cinereus (*Gmelin*): BLACK-TAILED SHEARWATER

COUES—*Adamastor cinereus,* II, 119, 142; *Priof*[*inus*]*cinereus,* V, 192.
SALVIN—*Priofinus cinereus,* 390, 455.
GODMAN—*Priofinus cinereus,* xliii, 155, pl. 41.

Whether the present species is more than a casual visitor in the region we are considering is yet to be ascertained, Colonel Pike's well-known specimen apparently remaining unique. Lately I reëxamined this specimen, which is now in the possession of the American Museum of Natural History, and copied the following data from the labels attached to it:

[1] Distal primary not fully grown.

First label: "Adamastor typus Bonap. Puffinus cinereus Gm.? California off Monterey. Procellaria hasitata 'Kuhl' Gould. B. Austr. vii pl. 47. Presented by N. Pike."

Second label: "Coll. Geo. N. Lawrence. Puffinus cinereus, Gm. California coast. 651. Presented by N. Pike Esq."

The American Museum catalogue number is 45967.

It may be well to recall the fact that the description of this specimen served as a description of the species in Dr. Coues's monograph.[1]

Dr. S. Kneeland's record[2] of the occurrence of this shearwater "in considerable numbers" off the coast of California is based on mistaken identification; the birds he saw were undoubtedly Black-footed Albatrosses.

As no mention is made of *Puffinus creatopus,* it is highly probable that the species observed by Capt. R. Paefsler in latitude 17° 4′ N., longitude 101° 6′ W. was *Puffinus creatopus* and not *Priofinus cinereus.*[3]

Puffinus creatopus *Coues:* Cooper's Shearwater; Pink-footed Shearwater

Plate 13

Coues—*Puffinus creatopus,* II, 131, 144, V, 192.
Salvin—*Puffinus creatopus,* 369, 376.
Godman—*Puffinus creatopus,* vi, xli, xlii, 101, pl. 27.

Dr. Cooper was the first writer to give vernacular names to this species, designating it Red-footed Puffin and Red-footed Shearwater.[4] Later, it was called Flesh-footed Shearwater and Pink-footed Shearwater, names also applied to *Puffinus carneipes.* Recently, Dr. Godman has proposed a new name, Coues's Shearwater.[5] A more appropriate appellation, however, is the one adopted in the headline above in honor of the discoverer of the species, Dr. James Graham Cooper.

Cooper's Shearwater is a South Temperate Zone species whose exodus-migration is protracted beyond the Tropic of Cancer. Off Point Pinos, California, it is common from May

[1] See II, p. 120, footnote.
[2] Amer. Nat., v. 5, pp. 312, 313.
[3] "Den 16. April in 17, 4° N 101, 6° W: viele *Puffinidae—Procellaria cinerea* ähnlich." J. f. O., 1913, v. 61, p. 49.
[4] Proc. Calif. Acad. Sci., v. 4, 1868, p. 11; 1870, p. 69.
[5] Mon. Petrels, p. vi.

to November. Scouts arrive early (Mr. Beck's earliest record being four shot and four others seen, February 27, 1907) and stragglers linger on into December. So far as I know, the species has not been reported north of Point Arena, California.[1] According to Mr. Gifford, during the voyage of the *Academy* this shearwater dropped out of sight on July 22, 1905, in latitude 22° 25′ N. and longitude 112° 40′ W., and was not met with again, its migration-route being inside of the schooner's course.

Dr. Godman has called attention to "a dusky phase of plumage,"[2] but the extremes of coloration are greater than he surmised. In the light extreme, the general color aspect from bill to crissum is white uninterrupted by gray, while in the dark extreme this aspect is superficially gray. In the darkest of the one hundred and thirty-nine specimens before me (No. 16059 C. A. S., male; plate 13) the chin, throat, and jugulum are heavily barred with gray and grayish white, and the rest of the lower parts is densely clouded with gray; the sides of the head, neck, and body and the lower tail-coverts are without white variations; the lining of the wings and axillaries are dark brownish gray, the former variously varied and the latter slightly tipped with grayish white. Only three other specimens of the series are of this extreme dark phase. One of them (No. 18557 Mus. Vertebr. Zool. U. C., female) is not quite so dark below as No. 16059; the remaining two (Nos. 15759 and 15760 C. A. S., males) are still lighter, and grade through intermediates of all sorts into six extreme examples of the light phase, of which No. 9387 C. A. S., female (plate 13), is typical. In this specimen the concealed portions of the longer primaries are white; the lining of the wings presents chiefly a white surface, and white rather predominates on the shorter lower tail-coverts; the abdomen is immaculate, save a few faint indications of gray near the crissum. It is a notable circumstance that growing feathers in both phases are like the worn ones they are replacing.

[1] Since the completion of this paper, the following has been communicated to me by Mr. Stanton Warburton, Jr., of Tacoma, Washington: "Shearwaters were first seen [by me] off the coast of Clallam County, Washington, June 28, 1917. Both the Pink-footed and the Sooty were common there, the Sooty being the most common. On the 29th, a pair of each was collected. On the 30th, off the coast of Grays Harbor County, Washington, about thirty miles, one Black-footed Albatross was seen, as well as quite a few of both the above kinds of shearwaters."

[2] Mon. Petrels, p. 103.

The precise nature of the double coloration in this species is not positively determinable from the material at hand. However, the burden of proof lies with age and geographic variation, not with dichromatism, a dominant condition in some Tubinares. Transitional specimens showing the passage from the natal down to the definitive feathers would reveal the whole matter at a glance, settling it beyond a peradventure.

In fresh plumage, the interscapulars, scapulars, and inner secondaries are usually washed with gray and margined with grayish white, the latter producing a decided scaled appearance. In the extreme dark birds the margins incline to pale brown or brownish white. Fresh primaries and rectrices are sometimes heavily frosted with gray, rendering their black shafts very conspicuous. Gray and grayish white filoplumes occur in numerous specimens on the pileum and auriculars, and less frequently on the cervix. No. 9308 C. A. S. has thirteen fully developed rectrices, six on the right side and seven crowded ones on the left.

The Academy's series of one hundred and thirty-eight specimens, obtained north of the Tropic of Cancer, is distributed throughout the year as follows: February 27, four specimens; April 25 and 29, nine; May, twenty; June, thirty-three; July, twenty; August, eight; September, thirteen; October, twenty; November, nine; December, two.

The four specimens of February 27 are in process of a complete moult, apparently postnuptial. In two of them, it affects the head and body generally and the upper and lower tail-coverts, but does not involve the primaries and wing-coverts, which are old and worn. The replacement of a middle and a lateral rectrix in one of the specimens appears to be normal renewal. The two remaining specimens (both in poor feather) are sprouting the inner primaries and greater and lesser wing-coverts as well as renewing the plumage of the head and body and the lower tail-coverts.

In the birds of April 25 and 29 (all in worn plumage) the moult has made but relatively little headway; in only one example has it reached the inner primaries. Probably the April birds were later breeders and later migrants than the February ones and therefore later in their moulting.

Twelve of the twenty May specimens were taken on the first day of the month and are in about the same stage of wear and restoration as the April ones, which is also true of a specimen shot on the 15th. In one secured on the 18th, the moult has extended to the greater and lesser wing-coverts and the six inner primaries. Three specimens procured on the 27th, 28th, and 29th show further progress. Only the outer four old primaries are left and the new inner ones are pushing out beyond the secondaries, which are also involved in the moult. A middle and a lateral rectrix are being renewed in one of the specimens. Three others, obtained on the same days, have lagged behind, two retaining the outer five old primaries and one all of them.

The thirty-three June examples (none of them hornotines) exhibit considerable diversity in the extent of the moult, but as a whole marked advancement has been made over April and May renewals. Three of five examples secured on the 27th retain four worn outermost primaries while two obtained on the 22nd and 25th have moulted all of the primaries except the first. Generally the replacement has progressed in the wing-coverts and in the tail and secondaries.

In most instances, the twenty specimens of July (2nd to 18th) have kept pace with the season in their feather renewal. Nine of them, obtained on the 18th, have moulted all of their primaries. However, abraded feathers elsewhere are not wanting as an index of age. A specimen of the 7th, one of the 8th, and two of the 10th have retained the first of the old primaries and another of the 8th also the second on the right wing. Three specimens, shot on the 2nd, 10th, and 18th respectively, have the outer two old primaries left and two specimens of the 8th the outer three and one specimen of the 7th the outer six. In the most advanced specimens all the rectrices have been moulted. Already the new greater and middle wing-coverts show wear, and this before the moult has been completed. It may truly be said that such birds are never in full feather.

None of the eight August specimens (shot on the 2nd, 22nd, 23rd, 27th, and 30th) have completed the moult of the upper and lower parts of the head and body, but the old primaries and rectrices have been cast. Destructive changes are already

rife, and the discrimination of the plumage generations is rather perplexing in some instances.

Continued, but ununiform, progress is manifested in the feather renewal of the September series, which is distributed as follows: 2nd, one specimen; 8th, two; 9th, two; 14th, one; 18th, one; 22nd, one; 23rd, five. Viewed superficially, certain specimens appear to be in full plumage. Closer examination, however, reveals the presence of old feathers, worn new ones, and growing feathers. In only five cases has the first primary outgrown the second one. According to Mr. Beck, incipient erotic enlargement of the generative organs was displayed in a male and female of the 23rd, indicating the approach of the season of reproduction.

The twenty specimens of October (4th to 25th), seven of November 4, and two stragglers of November 30 and two of December 9 complete the material under consideration. The primaries, except in two specimens, are in a good state of preservation, but the greater, middle, and lesser wing-coverts as a rule are much worn. Mr. Beck reports functional activity of the testes in three such specimens, taken October 21 and November 4 and 30; in each, feather replacement is nearly or quite at a standstill. In some of the other October and November specimens slight renewal is in progress, particularly on the breast and abdomen. In a December straggler, having slightly worn primaries, growing contour-feathers occur beneath the surface on the jugulum, breast, abdomen, side of neck, cervix, and dorsal region. Rectrices are also being replaced in this December specimen, in one of November 4, and in four October specimens, shot on the 4th, 15th, and 21st.

The progressive character of the renewal during the months preceding October tends to show that the later feather growth is the culmination of a protracted moult rather than the beginning of a definite new one. Nevertheless, it may be that a postnuptial merges into a limited prenuptial moult and that there is a deferred limited postjuvenal one.

The following table summarizes the measurements in millimeters of ninety-three males and thirty-seven females—all from the North Temperate Zone. The wing-measurements are only approximately correct, the distal primary being worn or not fully grown in some instances.

	Sex	Wing	Tail	Culmen	Upper Mandible		Tarsus	Middle Toe and Claw
					Depth	Width		
Maximum	♂	351	127	46.1	13.7	19.4	53.9	72.9
Minimum	♂	320	103	40	11	16.2	47.4	64
Mean	♂	333	114	43.4	12.2	17.9	50.2	67.8
Maximum	♀	344	123	43.9	12	18.5	52.2	70.5
Minimum	♀	318	110	39.9	11	16.5	47.1	63.2
Mean	♀	330	116	41.9	11.5	17.4	49.8	66.6

From the above, it appears that sexual variation in size plays an unimportant part in this species.

Puffinus opisthomelas *Coues:* Black-vented Shearwater

Plates 14-16

Coues—*Puffinus opisthomelas,* II, 139, 144.
Salvin—*Puffinus opisthomelas,* 369, 380.
Godman—*Puffinus opisthomelas,* xli, 109, pl. 30.

Examination of the type of *Puffinus opisthomelas* Coues (No. 16991 U. S. Nat. Mus.) and the type of *Puffinus auricularis* C. H. Townsend (No. 117540 U. S. Nat. Mus.) shows that each of these types represents a distinct species and that the small white-breasted shearwater occurring commonly off California is *Puffinus opisthomelas* Coues, of which *Puffinus couesi* Mathews[1] is a synonym.[2]

After breeding on Lower California islands, Black-vented Shearwaters migrate northward along the coast as far at least as Vancouver Island, their fly-line thus extending about fifteen hundred nautical miles.

In the vicinage of Point Pinos, California, neither Mr. Beck nor myself has met with these shearwaters in May and June. Stray individuals occasionally appear at the end of July, but ordinarily the first arrivals come in August and sometimes not before September. They are irregularly abundant through autumn and more or less common thereafter until the close of April. I found them common through December, 1912, but they were extremely wary and I only succeeded in securing fifteen specimens, several of which exhibited great functional

[1] Cf. Birds Austr., v. 2, p. 67.
[2] In the Auk for October, 1917, pp. 472, 473, Mr. Oberholser has also reached this conclusion.

enlargement of the testes. In following "the feed" when the sea was calm, they would dive from wing, flying directly into the water, disappearing wholly from view. When resting on the placid surface, they took wing readily, differing in this respect from the Murres and Rhinoceros Auklets, with which they were sometimes associated. In coming down the wind during a strong breeze, they changed their rapid wing strokes and short sail to an undulating sailing flight, much elevated for a shearwater.

The Galapagos Expedition first encountered Black-vented Shearwaters on July 2, 1905, off San Miguel Point, Lower California. On the 7th they were abundant off Banda Point, and the last were seen on the 14th near West Benito Island. At Natividad Island on the 19th, only deserted burrows closed by cobwebs were noted. In 1903, the Revilla Gigedo Expedition found them breeding sparingly on San Benito Islands on May 6 and abundantly on Natividad Island on May 9. No nestlings were discovered, only incubated eggs.

Like Cooper's Shearwater, the present species has a double style of coloration. In the extreme dark phase, the gray predominates over the fore-neck, strongly contrasting with the white of the rest of the lower parts (plate 14). It also interrupts the white lining of the wings and is much extended on the axillaries and sides of the body. In No. 9491 C. A. S. the gray in faint spots invades the breast and abdomen, becoming less distinct posteriorly. In the extreme light phase, the fore-neck is immaculate white (plate 14), the lining of the wings displays few if any traces of gray, and the axillaries and sides of the body have the gray much restricted. White nearly supplants the dark color on the shorter lower tail-coverts in Nos. 9474 and 9516 C. A. S. Between the dark and light extremes of the two phases, lies the great majority of the Academy's one hundred and thirty-nine specimens.

The explanation of the double form of coloration prevailing in this shearwater is apparently found in dichromatism rather than in age variation, for in the worn breeding plumage of both phases the growing feathers on the fore-neck are like the old ones they are replacing. Specimens passing from the natal down into the definitive feathers would present conclusive evidence.

New scapulars and interscapulars are blackish brown, margined with brownish gray. In some instances the lower eyelid is more or less white. Many specimens have gray or grayish white filoplumes on the occiput and some have them also on the auriculars and cervix.

It should be borne in mind that the brown aspect increases with wear, gray assuming a brownish shade and blackish brown becoming wholly brown. A description of this species should therefore cover both fresh and faded plumages. Abrasion in the dark phase eliminates the terminal white and lessens the subterminal gray of the feathers of the fore-neck, giving it at first a darker, and afterwards a lighter appearance.

A peculiarly significant example of melanism is found in a female of this species (No. 18691 Mus. Vertebr. Zool. U. C.) taken at Monterey Bay, California, December 19, 1910, by Mr. R. H. Beck. The entire lower surface is mouse gray, whitening toward the bases of the feathers and deepening superficially on the fore-neck, malar region, and sides of neck and body—areas of intensity of color in the dark phase. The under coverts of the wings and the axillaries are mouse gray, varying in tone. There is no departure from the normal coloration on the upper parts, and the size and proportions conform throughout with ordinary specimens. The dimensions are as follows: Wing about 240 mm.; tail 75; culmen 37.2; depth of upper mandible 8.4; width of upper mandible 13.4; tarsus 45; middle toe and claw 54. That dichromatism in the Tubinares had its origin in melanism is strongly suggested by this specimen (see plates 15, 17). Another example of melanism occurs in a male Murre (No. 18072 C. A. S.) obtained by Mr. John Rowley on Southeast Farallon Island, California, on May 30, 1911. In this specimen the jugulum, breast, and sides are fuscous and all the under coverts of the wings are deep mouse gray (plate 16).

No. 22013 Carnegie Mus., June 28, 1897, is in worn double-down. Both segments are mouse gray in color, becoming lighter on the median lower parts of the body. No. 22012 Carnegie Mus., June 28, 1897, is going out of the natal down. The scapulars, primaries, secondaries, and wing-coverts are emerging from the sheath and definitive feathers are appearing on the lower parts at the base of the secondary down. In coloration it agrees with the preceding specimen.

With the exception of four July (1905) specimens from the ocean off Banda Point, Lower California, the Academy's series was taken as follows in the vicinity of Point Pinos, California: August, 1907, four specimens; September, 1907, eighteen, 1909, one; October, 1907, twenty-two; November, 1907, thirteen; December, 1909, one, 1912, fifteen; January, 1908, eleven, 1910, two, 1913, one; February, 1907, twelve; March, 1907, eighteen; April, 1907, seventeen.

The four July birds are in faded brown dress. One of them, obtained on the 5th, is acquiring new feathers on the throat, jugulum, breast, abdomen, lower tail-coverts, crown, occiput, cervix, and dorsal region. Of the remaining three, all secured on the 7th, two are not quite so forward and one is further advanced, its five inner primaries and greater and lesser coverts being in process of renewal along with feathers of the pileum, cervix, dorsal region, upper tail-coverts, and under surface, including lower tail-coverts.

Much diversity exists in the moult of the four August specimens; none of which are hornotines. A specimen taken on the 7th has dropped all of the primaries except the distal one. Corresponding progress has been made in the wing-coverts, tail, and upper and lower parts. An example shot on the 10th has lagged behind. Seven worn outermost primaries and all of the old rectrices are in place, with feather growth active beneath the surface on the upper and lower tail-coverts, throat, jugulum, breast, abdomen, pileum, cervix, scapulars, interscapulars, and greater and lesser wing-coverts. A bird of the 30th has shed all the old primaries, while another of the same day has kept three of them on the right wing and two on the left.

September specimens also show unequal advance in their feather renewal. Thirteen retain old primaries as follows: One of the 30th, the first primary; two of the 18th and one each of the 23rd, 25th, and 27th, the two outer primaries; two of the 4th and one each of the 18th, 23rd, 25th, and 27th, the three outer; one of the 2nd, the four outer. The worn condition of the old primaries plainly indicates that these birds are not young-of-the-year. Of the remaining six examples, one of the 2nd, one each of the 4th and 25th, and three of the 27th have moulted all of the old primaries, prominent age-marks.

However, left-over feathers elsewhere furnish proof of maturity in three instances.

A general renewal is progressing in the twenty-two October birds. Seven (two of the 7th, one each of the 11th and 18th, two of the 23rd, and one of the 30th) have doffed all of the old primaries, but in no case has a new distal primary attained full growth. Two birds of the 30th have kept the outer two old primaries while three of the 3rd have retained only the first, further illustrating the absence of uniformity in the progress of the moult.

Of the thirteen November examples, five have failed to cast the old primaries as follows: One of the 13th, the first on the left wing; one of the 6th and two of the 15th, the first; one of the 22nd, the outer three. In the other eight examples new primaries have replaced the old. The first, however, has not overtaken the second, save in a single instance on the left wing.

Growing feathers occur to some extent in all of the December specimens, in nine of them even in the tail. In only four (one each of the 6th and 14th and two of the 26th) does the first primary still fall far short of the second.

Most of the January birds are in good plumage, although they display, with two exceptions, more or less replacement under way on the body and in some cases on the head and neck. Three are behind all the others in the rehabilitation of the wings and tail. One of these tardy individuals, shot January 2, 1908, has retained ten old rectrices and the old distal primary. Another, taken January 3, 1913, has the distal primary about three fourths grown and six rectrices in various stages of development. In the remaining one, obtained January 2, 1908, the distal primary equals the second, and six rectrices are being renewed.

February specimens also show moult. One taken on the 25th is replacing three rectrices and numerous feathers on the upper and lower parts. Another of the 25th is renewing fewer feathers on the head, neck, and body and but two rectrices. Most of the others exhibit some growing feathers above and below. Already disintegration is very apparent.

March and April specimens show increasing wear and the final disappearance of growing feathers. Some of the laggards in much worn attire may be hold-overs.

The above review of specimens demonstrates the existence of a protracted postnuptial moult in this species. I can not positively affirm from the specimens at hand whether there is, or is not, a limited prenuptial moult or a deferred limited postjuvenal one.

In unworn plumage the white phase of *Puffinus opisthomelas* and *Puffinus auricularis* present, in the material before me, the following distinguishing characters:

P. opisthomelas	*P. auricularis*
General aspect above dark brown.	General aspect above black.
Sides of neck mottled with gray, more or less brownish in shade.	Sides of neck more or less mottled with black.
Sides brownish gray (often discontinuous), posteriorly the feathers narrowly tipped with white.	Sides white, sometimes slightly dark gray posteriorly, but feathers not narrowly tipped with white.
Brown predominant in the dark color of the lower tail-coverts.	Black predominant in the dark color of the lower tail-coverts.
Axillaries subterminally dark brownish gray, narrowly and evenly tipped with white.	Axillaries sometimes subterminally dark gray, unevenly tipped with white.

Puffinus auricularis, like *Puffinus opisthomelas,* browns with the wear of the feathers. The measurements of the two species overlap.

The extreme and average dimensions of sixty-two males and forty-one females of *Puffinus opisthomelas* are set forth in millimeters in the annexed table. As the distal primary is worn or not fully grown in some cases, the wing-measurements are only approximately accurate.

	Sex	Wing	Tail	Culmen	Upper Mandible		Tarsus	Middle Toe and Claw
					Depth	Width		
Maximum	♂	254	84	39.5	9	15.6	45.5	55.8
Minimum	♂	234	74	34.8	7.8	11.6	39.4	49
Mean	♂	244	78	37.3	8.4	14	43	52
Maximum	♀	252	83	38.5	8.6	15.5	45.9	54.5
Minimum	♀	235	71	33.3	7	11.5	39.4	48
Mean	♀	243	79	35.7	7.7	13.4	42.3	51.4

Taking the above tabulation as a criterion, the males have but little advantage over the females in size.

Puffinus auricularis *C. H. Townsend:* Townsend's Shearwater

Salvin—*Puffinus auricularis,* 369, 380.
Godman—*Puffinus auricularis,* xli, 112, pl. 31; *Puffinus newelli,* xli, 115.

Unlike its congener the Black-vented Shearwater, Townsend's Shearwater appears to be non-migratory, remaining the year round in the general vicinage of its breeding grounds. In the passage south in 1905, the first representatives of the species logged by Mr. Gifford were three individuals in latitude 19° 37′ N. and longitude 111° 11′ W. on July 25, and the last were two in the vicinity of Clipperton Island on August 9. On the return voyage in 1906, the first one was noted in latitude 12° 19′ N. and longitude 104° 3′ W. on October 2, and the last in latitude 19° 53′ N. and longitude 118° 1′ W. on October 25.

There are only four specimens in the Expedition collection, and all are from the high sea. To supplement this meager series, I have borrowed the following: from the Carnegie Museum fourteen adults and five young in down collected on the Revilla Gigedo Islands; from the Bishop Museum the type of *Puffinus newelli* Henshaw from Maui Island and also a specimen obtained on Kauai Island; and from the U. S. National Museum the type of *Puffinus auricularis* C. H. Townsend.

A study of the material enumerated shows that there are no constant characters differentiating the Hawaiian from the Revilla Gigedo birds. Both belong to one species, *Puffinus auricularis.* The lower tail-coverts are extensively white in three Expedition and three Revilla Gigedo examples. The mottling on the side of the neck is present in the Kauai specimen, and in one of the Revilla Gigedo specimens it is continued across the jugulum in a band about seven eighths of an inch in width. The axillaries in all except the Kauai bird exhibit indications of dark color, in two Revilla Gigedo individuals forming conspicuous subterminal patches. Examples in fresh plumage from Revilla Gigedo waters are as black as the two Hawaiian birds. It is largely this black coloration that separates *Puffinus auricularis* from the closely allied *Puffinus opisthomelas.* (Concerning the relationship of these

two species, see the account of the latter.) As shown in the accompanying table, the measurements of the specimens of *P. auricularis* from the Revilla Gigedo and Hawaiian archipelagoes overlap.[1]

The following are the colors of the naked parts as taken in the flesh by Mr. Gifford: "Upper mandible blackish with bluish spot on each side near base; lower mandible blackish above sulcus and at tip, blue below sulcus; orbital ring black; iris dark brown; feet pinkish white, with some black on toes and edges of webs."

The five downy young from the Carnegie Museum exhibit several stages in the development of plumage. No. 21943, May 1, 1897, and No. 21938, April 30, 1897, are in the protoptyle state, and in color are dark smoke gray, becoming grayish white on the lower parts. No. 21951, May 23, 1897, is more advanced, the mesoptyles having appeared. The coloration is the same as in the preceding. No. 21937, April 30, 1897, is still older and has the protoptyles much worn. It is like the others in color, the dark smoke gray and grayish white reaching to the very base of the mesoptyles. No. 21954, May 25, 1897, is passing out of the natal down into the definitive feathers. The protoptyles have almost disappeared. Vestiges of grayish white ones remain on the jugulum. As the mesoptyles all appear to be dark smoke gray, perhaps a double coloration existed in this bird, the protoptyles being light and the mesoptyles dark on the lower parts.

The adults from the Clarion and San Benedicto colonies (taken between the 1st and 31st of May) are in worn plumage and almost without exception show feather renewal in progress beneath the surface, apparently the beginning of a postnuptial moult. Three Expedition birds (obtained on the 9th and 12th of October) are finishing a complete moult.

[1] Obviously, *Puffinus bannermani* Mathews & Iredale (Ibis, 1915, p. 594) is a variation of *Puffinus auricularis* C. H. Townsend, which Messrs. Mathews and Iredale confuse with *Puffinus opisthomelas* Coues. See my account of this latter species.

MEASUREMENTS (in millimeters)

No.	Sex	Length	Extent	Wing	Tail	Culmen	Upper Mandible		Tarsus	Middle Toe and Claw
							Depth	Width		
811	♂	345	721	.....	74	33	8.4	12.2	42.9	49.1
21947[1]	♂	.....	.....	224	79	32	8	12.6	42.4	47.9
21949[1]	♂	.....	.....	222	77.8	31.9	8	12	43	48.8
21953[1]	♂	.....	.....	236	77	35	8.3	12.9	46	50.1
810	♀	368	775	242	77	33.4	8	11.1	43.5	49.1
812	♀	.....	.....	.....	75	31.2	7	12.2	41.2	46.4
813	♀	363	.....	238	81	32.4	7.8	11.9	40.7	46.8
21936[1]	♀	.....	.....	226	78	31	8	12.3	42.6	48.5
21939[1]	♀	.....	.....	230	78	31	8	12.5	43.5	49.2
21941[1]	♀	.....	.....	239	80	35	8	12	44.9	50
21944[1]	♀	.....	.....	230	76	32.1	7.5	11.5	44	49.5
21945[1]	♀	.....	.....	228	71	32	8	12	43.2	48.1
21946[1]	♀	.....	.....	229	79	31.2	7.6	11.5	44	48.2
21948[1]	♀	.....	.....	227	78	32	8.4	12.5	44.4	49.8
21950[1]	♀	.....	.....	224	79	30.9	7.8	12.1	41.2	46.2
117540[2]	♀	.....	.....	229	80	30	7.5	12.3	43.5	48.5
1100[3]	....	.....	.....	240	80	33.8	9	13.7	46.5	51.6
4292[4]	....	.....	.....	221	77	33	8	12.5	46	47

Puffinus obscurus (*Gmelin*): DUSKY SHEARWATER; LEAST SHEARWATER

COUES—*Puffinus obscurus*, II, 137, 144; *Puffinus nugax*, II, 141, 144; [*Puffinus*] *assimilis*, V, 192.

SALVIN—*Puffinus obscurus*, 369, 382; *Puffinus assimilis*, 370, 384; *Puffinus persicus*, 369, 381, pl. 4; (?) *Puffinus elegans*, 370, 385.

GODMAN—*Puffinus obscurus*, vi, xlii, 126, pl. 34; *Puffinus subalaris*, xli, 117; *Puffinus auduboni*, xlii, 129; *Puffinus assimilis*, xlii, 133, pl. 35; *Puffinus bailloni*, xlii, 138; *Puffinus persicus*, xlii, 124, pl. 33; (?) *Puffinus elegans*, xlii, 136, pl. 36.

Following Lord Rothschild and Dr. Hartert,[5] I have grouped under *Puffinus obscurus* several book species, believing them to be merely variations of a single widely distributed and essentially non-migratory species. The material before me confirms that the intergradation is complete between the brownish-backed and bluish-backed birds and that they are not separable as distinct species. Perhaps the explanation of the dual coloration is to be found in dichromatism, more or less modified by geographic variation. *Puffinus persicus* Hume has been included in the synonymy, as it is

[1] Carnegie Museum.
[2] Type of *Puffinus auricularis;* U. S. National Museum.
[3] "*Puffinus newelli*," Bishop Museum.
[4] Type of "*Puffinus newelli*," Bishop Museum.
[5] Nov. Zool., v. 6, pp. 194-197.

not upheld in the descriptions by constant characters, also *Puffinus elegans* Giglioli & Salvadori with a question, its status being open to doubt.

I do not agree with Mr. Gregory M. Mathews in his rejection of Gmelin's *obscura* as the specific name of this species.[1] The Leverian Museum specimen (preserved in the Imperial Museum at Vienna[2]) and Latham's description seem to me to be a sufficient warrant for retaining the name. The two inches difference in length, stated by Latham to exist between the Leverian and the other specimen at his command, may have been due in part to the make-up of the specimens. However, the discrepancy does not exceed the limits of geographic variation in this species. Even the variation in eighteen Galapagos females, measured in the flesh, reaches 25 mm. Furthermore, the length of the bill, measured along the cutting edge, in some specimens equals Latham's dimension: "Bill an inch and a half."

According to Mr. Gifford, the Dusky Shearwaters of the Galapagos colony apparently do not wander far from their birthplace. None were seen beyond latitude 5° 30′ N., longitude 87° 5′ W. and latitude 2° 29′ S., longitude 90° 4′ W. Throughout the archipelago they were very common, haunting alike the sheltered bays and coves and the open sea. They probably breed on most of the islands, although eggs or downy young have been reported from only three. The Expedition found at Hood Island a fresh egg and a nestling on September 28, a nestling on October 2, fresh and incubated eggs on February 1, fresh eggs on February 6, and nestlings on June 25. Moreover, two birds were seen to enter holes in a cliff on Champion Island in February and one was noted in a hole in a cliff on Indefatigable Island in July. Messrs. Snodgrass and Heller record a single egg taken in December on Wenman Island[3] and Lord Rothschild and Dr. Hartert state that downy young were found on the same island in February[4] and a great many eggs on Culpepper Island in July.[5] It appears, therefore, that relays protract the breeding season, with the laggards causing it to cover most, if not all,

[1] Birds Austr., v. 2, pp. 64-68: compare my remarks under *P. opisthomelas*.
[2] Ibis, 1873, p. 47; Birds Austr., v. 2, p. 64.
[3] Proc. Wash. Acad. Sci., v. 5, p. 241.
[4] Nov. Zool., v. 9, p. 414.
[5] Ibid., v. 6, p. 196.

of the year. Perhaps there are two distinct breeding seasons, some birds laying in winter, others in summer.

At Hood Island, quoting in substance from Mr. Gifford's notes, they nested in small tunnel-like holes in the lava sea cliffs. The lowest holes were near the water and were damp, and the highest were sixty or seventy feet above it. As in some other petrels, the male and female become tenants before the laying of the single egg, which is placed at the farther end of the hole, usually on the bare soil or rock, sometimes within arm's reach of the entrance.

These shearwaters are generally silent. However, on two occasions in January small flocks were flying about the cliffs at Academy Bay, Indefatigable Island, making a twittering sound. One evening near Essex Point, Albemarle Island, a flock of about a hundred was fishing. There was great excitement among them. Rushing madly about, they kept up a continual twittering. Twice at Hood Island, birds in their nesting holes were heard uttering notes somewhat resembling the mew of a kitten. In each instance the hole was tenanted by a pair of birds. These mewing notes, or one or two short shrill notes, were sometimes uttered when the collector's hand was thrust into the hole, which intrusion was always resented, a spirited defense being made with bill and claws. They showed a disposition to bully other birds. One was seen pursuing a Turnstone and several pestered a Brown Pelican until he retreated to a cliff to escape from the annoyance.

Like some others of their tribe, they were sociably inclined, frequently flying about the cliffs and rocks in small compact companies or congregating on the water or winging their way at times over its surface in loose flocks and straggling columns. When fishing, a community of interests was often formed with other species, particularly the Noddy and boobies.

The flight is usually low and somewhat undulatory, ascendant during the rapid wing strokes (which vary from four or five to eight or ten) and descendant during the short sail. In rough weather they rise higher and prolong the sailing flight, but do not attain to the "beautiful evolutions" of the Dark-rumped Petrel. In rising from a calm sea, they extend their wings and paddle rapidly forward for about two feet

when they clear the water and are fairly a-wing. When feeding in windy weather, they often alight for a moment without closing their wings. One proved himself well worthy of the name of petrel while picking up food during a brisk wind. He would poise for a moment, with wings outspread and feet just touching the water, and then dart to the windward for a few feet without flapping his wings, which apparently served the same purpose as "the sails of a vessel when close-hauled on the wind." On another occasion a flock of about thirty while feeding would fly slowly to the windward for a few rods, keeping close to the water, and then turn and fly swiftly back to the starting point and repeat the maneuver. In calm weather they collected in flocks on the water while feeding. On one occasion the birds of a company were continually putting their heads under water and when something edible was discovered they would dive, often remaining beneath the surface for a full minute.

The remains of small crustaceans were found in the stomachs of several birds taken from nesting holes on Hood Island in February. One day a number were flying about a brigantine at Villamil, Albemarle Island, apparently attracted by the droppings from the cattle that were being hoisted aboard.

Galapagos examples of this species exhibit considerable variation, and on the strength of certain features of this variation Mr. Gregory M. Mathews has endeavored to separate the birds of Culpepper and Wenman islands from those of the rest of the archipelago, holding that the former are larger and that their under wing-coverts and axillaries are less dusky.[1] As the Expedition males yielding the maximum measurements are from Hood Island and as certain specimens from that island have white under wing-coverts and axillaries, it is evident that Mr. Mathews has mistaken other variations for geographic variation.

The under wing-coverts and axillaries vary in general aspect from immaculate white to dark gray. The former extreme is typically represented in the Expedition series by No. 837, male, February 6, No. 859, male, May 21, No. 885, female, June 25, and the latter extreme by No. 839, male,

[1] Birds Austr., v. 2, pp. 62, 70.

January 5, No. 820, male, June 28, No. 881, female, May 21. In the white extreme the dark color of the flanks is much restricted. Like most of the birds in definitive feather, two individuals passing out of the natal down are intermediate, having the under wing-coverts gray and white. The amount of white is greater in one than in the other, suggesting that the two color extremes may occur in the juvenal plumage. A series emerging from the down would clear up the whole matter and determine whether these variations are to be credited to age or to dichromatism.

Both eyelids are white, and in some specimens there is an obscure whitish postocular streak. The suborbital region is frequently invaded by white, and the lores are flecked with it in several instances. Examples in high plumage have the greater and middle wing-coverts and scapulars broadly margined with grayish white and the feathers of the upper parts between the rump and bill edged with it, quite distinctly posteriorly and very faintly anteriorly. As in other dark-vented species, the crissum is more or less white. In certain specimens, whitish and brownish filoplumes occur on the crown, occiput, and cervix. No. 815 C. A. S. has albinistic feathers on the pileum and cervix, No. 888 C. A. S. has a tendency to melanism on the jugulum, and No. 854 C. A. S. possesses fourteen fully developed rectrices. The bill of the adult in life is black, becoming bluish on the lower mandible between the gonys and base; the irises are dark brown; the feet are usually flesh-colored, blackish on the outer side (*fide Beck* and *Gifford*).

In the Expedition collection there are five nestlings of this species representing successive stages of plumage development. No. 920, June 25, is in worn double-down with the scapulars just beginning to break from their follicles. Above, the specimen is deep mouse gray; below, it is mouse gray, relieved by a large grayish white patch on the abdomen and by a smaller one on the chest. The same coloration prevails in the natal down of the other specimens. No. 921, June 25, shows a marked decline in the natal down. The throat, chin, lores, orbita, and malar region are partially denuded. Following the lead of the scapulars, the remiges, exterior wing-coverts, and contour-feathers of the breast, sides, and upper

abdomen are making their appearance under the cover of the down. No. 922, June 25, has exposed contour-feathers on the interramal space, malar region, lores, orbita, and suborbital region. Beneath the surface down, the wings and tail have assumed definite form and the body, jugulum, and cervix have become pretty well clothed with contour-feathers. Postnatal down has also appeared. No. 919, October 2, has thrown off most of the natal down on the pileum, scapulars, wings, and upper tail-coverts, and all of it on the tail. Between the chin and crissum the down still persists as an outer covering. The greater and middle wing-coverts and inner secondaries are edged with brown of a more or less grayish tint. The scapulars, too, have paler margins, and under certain lights these feathers present a grayish appearance. No. 918, September 28, is almost entirely free from natal down, except on the abdomen and posterior portions of the breast, where the contour-feathers are hidden. The general color aspect of the upper parts is blackish brown. The wings are without conspicuous margins.

The Expedition series contains one hundred and four specimens in definitive feather, obtained as follows: January, three specimens; February, twenty-six; March, one; April, seven; May, twenty-eight; June, eighteen; July, two; August, seven; September, twelve. The majority of these specimens have more or less feather growth in progress, particularly on the body, neck, and pileum. Twenty-nine are renewing wing and tail feathers as indicated in the following table:

Date	Outer Primaries	Inner Primaries	Secondaries and Tertials	Wing-coverts	Rectrices
Jan. 5	1st, 2nd	.....	.....	.....	Six
Feb. 1	1st	.....	.....	.....	Five
" 5	.....	.....	.....	.....	Two
" 6	1st	.....	.....	.....	One
" "	1st	.....	.....	.....	Four
" "	1st	.....	.....	.....	Six
April 24	.....	9th, 10th	.....	.....	.....
" "	.....	9th, 10th	.....	.....	Four
May 19	1st	.....	.....	.....	Two
" 21	.....	10th	.....	.....	Three
" "	1st	.....	.....	.....	One
" "	.....	.....	.....	.....	One
" "	.....	6th, 7th, 8th, 9th, 10th	Innermost secondaries and tertials	Greater and lesser	.....
" "	.....	8th, 9th, 10th	.....	.....	.....
" "	1st	.....	.....	.....	One
" "	.....	8th, 9th, 10th	.....	.....	.....
" "	.....	8th, 9th, 10th	.....	.....	.....
" "	.....	.....	.....	.....	One
June 25	1st	.....	.....	.....	Six
" "	1st	.....	.....	.....	Two
" "	1st	.....	.....	.....	Three
" "	.....	.....	.....	.....	Three
July 30	.....	.....	.....	.....	Five
Sept. 2	.....	.....	.....	.....	One
" 28	1st	10th	.....	.....	Two
" "	.....	.....	.....	.....	One
" "	.....	.....	.....	.....	Two
" "	.....	.....	.....	.....	One
" "	.....	.....	.....	.....	Three

The measurements, taken in millimeters, presented in the table below are from forty-nine males and fifty females—all Galapagos specimens.

	Sex	Wing	Tail	Culmen	Upper Mandible		Tarsus	Middle Toe and Claw
					Depth	Width		
Maximum.....	♂	202	74	29.7	7.2	12.3	35.5	44.7
Minimum.....	♂	181	65	25.6	6	10.4	31.9	37
Mean.....	♂	191	70	27.6	6.5	11.3	33.8	41.3
Maximum.....	♀	203	77	29	7	11.9	36.5	43
Minimum.....	♀	181	63	25	5.5	9.6	31.5	37.8
Mean.....	♀	191	70	27.4	6.2	10.7	33.3	40.5

Length in flesh: Five males, 285-302 mm. (296); eighteen females, 285-310 mm. (299).

Extent: One male, 625 mm.; one female, 630 mm.

As evidenced by the foregoing dimensions, the males and females are not conspicuously dissimilar in size.

Three eggs from Hood Island measure in millimeters: 47.1x32.9; 48.1x33.9; 48.5x33.8. They are dead white, and in form ovate, inclining to elliptical ovate.

Puffinus carneipes *Gould:* Flesh-footed Shearwater

Coues—*Nectris carneipes,* II, 126, 143, V, 192.
Salvin—*Puffinus carneipes,* 370, 385.
Godman—*Puffinus carneipes,* xlii, 142, pl. 37.

So far as I am aware, this Southern Hemisphere shearwater has been reported for the eastern side of the Pacific only from the vicinity of Point Pinos, California, where Mr. R. H. Beck has secured during his various expeditions ten specimens for the Academy and four for the University of California. His first specimen was taken on November 23, 1903, and his second and third on November 24, 1904. These specimens were the property of the Academy and were destroyed in the Conflagration of April, 1906. The other Academy specimens (seven males) were obtained in 1907. Mr. Beck's notes concerning them are as follows:

During my eleven months' stay in 1907 I saw nine Flesh-footed Shearwaters. They were then perhaps more plentiful than in other seasons; though the close watch I kept on shearwaters that year and the abundance of Sooty Shearwaters partly account for so many being seen.

On February 27, while I was out six miles northwest of the buoy amongst a large flock of fishing birds, I noticed a Flesh-footed Shearwater flying past. A long shot caused him to circle off and drop; but in the choppy sea I would have lost him had not a Cooper's Shearwater circled about and showed the dead bird's position.

On April 29, about six miles northwest of the buoy, I scared up a small bunch of Sooty Shearwaters, and a Flesh-footed swung up and was shot.

June 25 was foggy, with shearwaters abundant from Moss Beach to Seal Rocks. A mile or so off Seal Rocks a Flesh-footed Shearwater, two hundred yards away, was seen flying

along towards Point Pinos. A dead Sooty Shearwater thrown into the air called him over and he was secured. He flew with slower wing beats and was more deliberate in flight than the Sooty Shearwaters.

On July 22, while I was trying to get early southbound Sabine's Gulls that were resting in company with Sooty Shearwaters some distance off Point Cypress, a Flesh-footed Shearwater flew up. A hasty shot, with but one barrel loaded, sent him off wounded, but I could not find him on the rippling water.

August 27 I was out about four miles northeast of Point Pinos amongst thousands of Sooty Shearwaters. As one of the constantly passing throng flew by me, I noticed the light-colored bill and shot the bird, securing thus another Flesh-footed Shearwater.

September 2, while in the same vicinity, one of the shearwaters that flew over my head from behind had a light-colored bill. Hastily dropping the oars and grabbing my gun, I shot the bird, and, as anticipated, it proved to be a Flesh-footed Shearwater.

October 28 I was out about six miles northeast of the buoy and noticed a Flesh-footed flying south with a single Sooty Shearwater. A long shot at seventy-five yards distance failed to stop him.

November 4 I got out about eight miles north of Point Pinos and in a large flock of about twenty thousand Sooty Shearwaters secured two Flesh-footed that flew up to me. No others were seen, though possibly present in other portions of the scattered flock. Two Buller's Shearwaters were taken here and also a Slender-billed Shearwater and several Cooper's Shearwaters.

Inasmuch as the light-colored bill is so characteristic in life, Pale-billed Shearwater would perhaps be a more fitting name for this species than Flesh-footed, or Fleshy-footed, Shearwater.

The four specimens belonging to the University of California were captured in 1910—a male and a female on September 7, a male on September 23, and a female on November 1.

On the labels of the two males of November 4, 1907, Mr. Beck notes that the testes showed functional activity, evidencing that the season of reproduction was beginning, not ending. Furthermore, the male of February 27, 1907, was taken on the same day that the advanced guard of Sooty and Cooper's Shearwaters appeared.

Judging from the manner of their occurrence, it seems evident that the Flesh-footed Shearwaters frequenting the ocean in the vicinity of Point Pinos, California, are regular, but not common visitors from the antipodes and that they follow in their exodus- and return-migrations the American coast route of the Sooty Shearwaters.

In fresh plumage the lower parts are deep mouse gray, in certain specimens more or less varied by obscure pale edgings, especially on the breast and abdomen. With wear the general aspect of the plumage becomes decidedly brownish. New inner primaries in some instances are frosted with gray, and in high feather the tertials and longer scapulars are margined with grayish white, and more rarely the greater wing-coverts are tipped with it.

So far as witnessed by the specimens at hand, the Flesh-footed Shearwater's moult corresponds with that of the Sooty and Cooper's shearwaters. In the specimen obtained on February 27 renewal is progressing on the crown, cervix, back, jugulum, breast, abdomen, and in the lower tail-coverts and tail. The wings are much worn, particularly the greater coverts. In the specimen secured on April 29 the five inner primaries (not counting the remicle) and two rectrices are being replaced. Although somewhat the worse for wear, the specimens taken on June 25, August 27, and September 2 have scarcely any replacement in progress. The male of September 7 is in fine plumage with relatively few worn or growing feathers. The female of the same date, however, is not as forward. In the male of September 23, in the female of November 1, and in the two males of November 4 the distal primary is not fully grown and there are still some old feathers on the back; otherwise the moult appears to be about completed.

MEASUREMENTS (in millimeters)

No.	Sex	Length	Extent	Wing	Tail	Culmen	Upper Mandible		Tarsus	Middle Toe and Claw
							Depth	Width		
9519	♂	470	1145	333	113	43.7	12.2	18	52.7	66.1
9520	♂	480	1090	322	113	43	11.7	17.5	52.2	68.4
9521	♂	485	.....	330	111	44.7	12	18.5	50.7	66.5
9522	♂	.....	.....	327	111	42	12	17.7	50.3	63.4
9523	♂	490	1105	325	119	43.4	12	18.1	49.3	66.2
9524	♂	470	1095	321[2]	108	44.2	12.7	18.5	51.7	64.3
9525	♂	480	1085	321[2]	113	42.9	11.9	18.5	50.8	69
18688[1]	♂	470	1092	326	108	40.2	11.3	18	51.1	66.4
18689[1]	♂	470	1092	325[2]	112	41.3	12.8	18	50	65
18687[1]	♀	489	1080	329	111	41.6	11	16.8	52.1	68.6
18690[1]	♀	483	1118	328[2]	116	42	12.5	18.4	52.8	67.4

Puffinus griseus (*Gmelin*): SOOTY SHEARWATER

COUES—*Nectris fuliginosus*, II, 123, 143; *Nectris amaurosoma*, II, 124, 143; *Puffinus fuliginosus*, V, 192; *Puffinus amaurisoma*, V, 192.
SALVIN—*Puffinus griseus*, 370, 386.
GODMAN—*Puffinus griseus*, xlii, 145, pl. 38.

After breeding in the South Temperate Zone, the Sooty Shearwaters in their exodus-migration cross the Equator in great numbers. Off Point Pinos, California, they arrive in strength during the latter part of April and in May, and are very abundant at intervals until later autumn. Stragglers occur after the departure of the hosts for their Southern Hemisphere breeding stations, Mr. Beck and myself having obtained individuals in December and January. Seventy-five observed by Mr. Beck on February 27, 1907, thirteen of which were taken, apparently belonged to the vanguard of that year's migration; in common with the Cooper's Shearwaters whose advent was on the same day.

Usually the Sooty Shearwaters avoid the landlocked harbors. At times, however, they follow their prey through the Golden Gate to San Francisco Bay, venturing as far as Alcatraz and Angel islands. The Expedition lost sight of them in the vicinity of the San Benito Islands, Lower California, and did not meet with them again until the home voyage was nearly over, the course of the schooner *Academy* being outside of

[1] Mus. Vertebr. Zool., Univ. Calif.
[2] Distal primary not fully grown.

their fly-line. But two specimens were preserved, and these were shot on November 19, 1906, in latitude 35° 40′ N., longitude 133° 14′ W.

The Academy's two hundred and twenty-three specimens, from the ocean off California, exhibit considerable color variation, particularly on the under surfaces of the body and wings. In extreme light examples, the chin and throat are grayish white; the basal and subterminal portions of the feathers of the jugulum and breast are also grayish white, giving to the lower parts a mottled appearance; the shorter axillaries are varied with grayish white; the under coverts of the wings are white with only slight indications of gray. In extreme dark examples, the chin and throat are deep gray, the basal portions of the feathers of the jugulum and breast are lighter gray, and the general aspect of the under coverts of the wings is gray instead of white.

Whether age, geographic variation, or dichromatism is the bottom fact in this dual coloration, can not be affirmed absolutely from the material at hand—skins of sea-killed birds. Nevertheless, the preponderance of evidence is in favor of dichromatism, for the growing feathers manifest no age transition, being like the worn ones they are succeeding, and on breeding grounds parallel examples of bicoloration occur in other petrels independent of geographic variation.

The superficial color of the lower parts varies in different specimens from mouse gray to deep mouse gray, more or less intensified on the jugulum. New primaries, secondaries, and wing-coverts are often frosted with gray and the dorsal feathers and tertials are sometimes quite distinctly edged with it. With the decline of the plumage, the coloration changes, wearing browner on the upper and lower parts. In a few specimens the supraloral region is varied with grayish white, and in some instances gray filoplumes adorn the occiput, auriculars, cervix, and sides of neck, and even the back anteriorly. No. 9577 C. A. S. has a supernumerary rectrix, the total number of rectrices being thirteen instead of twelve.

Albinism is not uncommon in this species. The Academy's collection contains half a dozen striking examples of it. In one specimen (No. 9705, female, June 17, 1907), the plumage of the head, neck, and anterior portions of the back and breast

is white, relieved by a few gray feathers on the throat. The rest of the body-plumage (except that of the rump) and the tail-coverts are extensively white. Nearly all the greater wing-coverts, the growing inner primaries, and some of the secondaries and scapulars are wholly white. According to Mr. Beck's label, in life the irises were brown and the feet and bill white, the latter tipped with brown. There is such regularity in the abnormal coloration that this specimen might be easily mistaken for a nondescript. In a second specimen (No. 16062, female, September 6, 1909), the plumage of the head and neck is immaculate white. The rest of the body-plumage (except the white-tipped scapulars), the wings, and the tail-coverts are largely white. Two specimens present a general pied appearance above and below. Another is conspicuously varied with white on the posterior portions of the pileum and on the cervix and sides of the head and neck. In the remaining specimen, the white variations are also pronounced, but are restricted to the back and sides of the head, with a partial invasion of the cervix and sides of neck.

The Academy's series is divided according to calendar months as follows: January, five specimens; February, thirteen; March, one; April, fourteen; May, forty-six; June, thirty-two; July, fourteen; August, sixteen; September, thirty-five; October, twenty-nine; November, twelve; December, six. In some cases these specimens represent the extreme results of abrasion and bleaching, Mr. Beck having selected them on that account.

As a whole, the Sooty Shearwaters obtained on February 27, 1907, are much further along in the moult than the Cooper's Shearwaters taken on the same day. The more forward examples are moulting the inner primaries, secondaries, wing-coverts, the rectrices and their coverts, and the plumage of the upper and lower parts. Several of the specimens appear to be in nearly complete attire, which old telltale feathers prove is not the sequence of a postjuvenal moult. One of the specimens is growing the eighth primary on each wing, although all the other primaries have apparently been replaced. In two backward examples, both in worn dress, none of the primaries or rectrices have succumbed to moult.

It is believed that the February birds are early breeders and therefore early in their migration and, with individual exceptions, in their moulting. Outdoor study will throw further light on these matters.

The single March specimen, obtained on the 8th, displays no obvious signs of feather growth in progress.

As in Cooper's Shearwater, April specimens of the Sooty Shearwater are later in their moulting than the February ones. Of eight showing definite feather restoration, only five are replacing their primaries. The usual individuality is manifested. A specimen taken on the 8th is renewing the three inner primaries on the left wing, and the two inner ones on the right, not counting the remicle. A specimen obtained on the 25th has made a slight advance and is renewing the three inner primaries on the left wing and the four inner ones on the right. In three specimens secured on the 29th, one is renewing the three inner primaries on both wings and two, the seven inner primaries. One of the last two specimens is also acquiring a new rectrix, the only instance of tail renewal in the entire April series. In some individuals, the primaries and other plumage are in relatively good condition, but worn and faded feathers are not wanting here and there to mark such birds as old ones, probably late in completing their previous moult.

May specimens show irregular advancement in their moulting. Of twelve captured on the 6th, eight have cast from three to five of the innermost primaries, and four, none of them; in three instances the greater and lesser wing-coverts are involved. Of five specimens taken on the 8th, one is in worn garb with no obvious feather replacement under way, while two are at the other extreme, being well along in the postnuptial moult, the foremost retaining only the first of its old primaries. Three of the 13th and two each of the 15th and 18th are as backward as those of the 6th. One of the 21st is in fine plumage with no dilapidated feathers betraying age, albeit it possesses some feathers still in the sheath, including four rectrices. In contrast, is a worn bird of the 24th with all its old primaries in place. As a whole, the remaining May specimens (four secured on the 21st, two on the 23rd, six on the 24th, and two each on the 27th, 28th, 29th, and 31st) show advance over

those obtained during the first half of the month. Most of them are renewing from five to six innermost primaries and the greater and lesser wing-coverts. A number, also, are beginning to replace their inner secondaries. Two are growing rectrices. The only other instances in the May series are the three forward birds of the 8th and 21st.

A specimen taken on June 1 has outstripped in the moult three specimens taken on June 27. Its plumage is in fine condition with but few worn or growing feathers. The three tardy birds are abraded and bleached with feather renewal active. Of the old primaries, four outermost are left in one specimen, three in another, and three on the right wing and two on the left in the remaining specimen. The rest of the June birds (in dates, scattered along between the 3rd and 25th) further illustrate individual variability in the moult; some have lagged behind and others have pressed forward. Viewed as a whole, the rehabilitation is more advanced than in the May series.

With the exception of one obtained on the 24th and another on the 26th, the birds secured in July were taken between the 1st and 12th of the month. In general, they show progress in the moult, and there is about the same proportion of backward and forward individuals as in the preceding months. One has the plumage of the lower parts of the body much worn, particularly on the anterior portions of the breast, where the feathers are frayed nearly to the shaft and badly faded. The fore-neck, upper parts, inner primaries, and some of the secondaries and wing-coverts are in good condition. None of the specimens appear to be birds-of-the-year.

Of the specimens taken during August, six were obtained on the 17th, eight on the 19th, and one each on the 27th and 30th. In one specimen, an old distal primary and numerous old dorsal feathers still resist the advance of the moult. Eight specimens have lost their worn feathers and are nearly in complete plumage. In each, the sheath persists in two or more rectrices and in the distal primary. Two other specimens are also in new dress, but feather renewal appears to be about over in them. The five remaining specimens show some wear and lesser replacement.

The series of September has its share of specimens that are late in finishing the moult. In eight (one each of the 2nd, 4th, 9th, 10th, 20th, and 22nd and two of the 27th) the distal primary and a varying number of rectrices are in process of growth. There is also more or less minor renewal progressing in these specimens and in most of the others of the series. Three are much the worse for wear on the lower parts, posterior to the jugulum, and on the greater and middle wing-coverts. On portions of the breast, and in spots elsewhere in the worn areas, the feathers are frayed nearly to the shaft and greatly bleached.

October and November specimens show rapid decline or complete cessation in feather growth. In three October specimens (one of them apparently out of health) it has not ceased in the primaries and rectrices, nor in the rectrices of two other October specimens and a November one.

The stragglers of December and January are about at a standstill in their plumage, except one of January 7, which is replacing feathers on the head, neck, and body.

The extensive series, reviewed above, makes it clear that there is a protracted postnuptial moult in this species, but does not make it clear that there is a limited prenuptial or a deferred limited postjuvenal one.

Tabulated below are the extreme and average measurements in millimeters of one hundred and sixty-five specimens (seventy-eight males and eighty-seven females) obtained off the coast of California.

	Sex	Wing	Tail	Culmen	Upper Mandible		Tarsus	Middle Toe and Claw
					Depth	Width		
Maximum	♂	314	94	47.3	11.9	18	56.9	69.4
Minimum	♂	282	80	40.1	9.1	14.5	50.3	60
Mean	♂	301	88	43	10.2	16.4	53.5	65.2
Maximum	♀	318	97	45	10.8	17.9	55.7	68
Minimum	♀	281	81	38.3	8.8	13.6	50	60
Mean	♀	299	89	41.8	9.8	15.9	53	64.2

Judging by the foregoing table, the majority of the females are somewhat inferior to the males in size.

Puffinus tenuirostris (*Temminck*): Slender-billed Shearwater

Coues—*Nectris tenuirostris,* II, 126, 143; *Nectris brevicauda,* II, 127; *N. brevicaudus,* II, 143.
Salvin—*Puffinus tenuirostris,* 370, 388.
Godman—*Puffinus tenuirostris,* xlii, 149, pl. 39.

As is well known, the Slender-billed Shearwater is a Southern Hemisphere species that penetrates into Arctic regions in its exodus-migration. Offshore in the vicinity of Point Pinos, California, it has been found by Mr. Beck and other collectors to be rather common in November or December in some years, and in others, rare or apparently absent. Individuals have also been met with by Mr. Beck in October and January, his earliest record being a solitary specimen, taken October 13, 1910, and his latest, a straggler taken January 30, 1908.[1] According to Mr. Beck's label, the ova in a female of December 2 were functionally enlarged. It should be added, that this species has not been detected in spring and summer in the hosts of Sooty Shearwaters.

The fact that the Slender-billed Shearwaters are late and irregular in their occurrence off Point Pinos is of peculiar interest, creating the doubt whether they are really returning migrants bound for South American breeding stations, or whether they are strays that have missed their way and, falling in with the rear guard of the Sooty Shearwaters, have come down the wrong coast, the American instead of the Asiatic. It is hoped that Mr. Beck's explorations off the mainland of Chile will clear up the matter.

No specimens of this species were brought back by the Academy's Galapagos Expedition.

Bicoloration in the Sooty Shearwater finds a counterpart in the Slender-billed. In extreme dark examples of the latter species the general aspect of the under coverts of the wings is gray; the feathers of the throat are superficially dark gray, becoming pale gray beneath the surface. In extreme light examples the general aspect of the under coverts of the wings is decidedly grayish white; the chin and anterior portions of the throat are likewise grayish white, sometimes mottled with

[1] The record for "April 10" in Dr. Grinnell's *Distributional List of the Birds of California,* p. 27, is a *lapsus calami.*

gray, and white, more or less tinged with gray, prevails at the base of the feathers of the jugulum and breast. The two extremes are linked together by intermediates. While the significance of this dual coloration has not been fully determined, the collateral evidence, which is of the same character as that presented in the Sooty Shearwater, is in favor of dichromatism —not of age or geographic variation. We must look to future investigations on nesting grounds for a final settlement of the case.

Judging from the original description, the type of *Puffinus intermedius* Hull[1] is apparently intermediate between the light and dark phases of *P. tenuirostris;* its bill is too short for *P. griseus.*

The dark gray of the lower parts varies somewhat in different specimens, and is often of a distinctly brownish shade, becoming still browner by wearing. In some specimens the feathers of the breast and abdomen are conspicuously tipped with pale gray. No. 9731 C. A. S. has numerous obscure brownish and brownish white bars on the throat and brownish ones on the sides of the head posterior to the eyes, and No. 9743 C. A. S. has fourteen fully developed rectrices.

Of the Academy's series of fifty-five specimens from the ocean off Point Pinos, California, three were taken in October, twelve in November, thirty-four in December, and six in January. The general condition of the plumage in this series is similar to that obtaining in the Sooty Shearwater during the same months of the year. Several specimens are belated in moult; two (Dec. 2, 9) have the distal primaries still in the sheath, and one of them, also three rectrices. Two other specimens (Dec. 2, Jan. 2) are growing single rectrices and two others (Dec. 2, Jan. 2) are renewing feathers on the hind neck and back. A couple of Alaskan specimens from the Carnegie Museum, taken June 25, are well along in a complete moult.

The relationship is very close between *Puffinus tenuirostris* and *Puffinus griseus.* As manifested in the accompanying tables, the maximum measurements of the former species overlap the minimum ones of the latter, except in the length of the culmen. The total length, taken from skins, also shows an overlapping, which, however, may disappear in measurements

[1] Emu, v. 11, p. 98.

taken in the flesh. The most tangible characters separating the two species are the form and dimensions of the bill. The bill of *P. tenuirostris* is shorter than that of *P. griseus;* it is also weaker at the tip and relatively, sometimes actually, wider at the base. The culmen in forty-four specimens measures 29.7—35 mm., while in one hundred and sixty-five specimens of *P. griseus* it measures 38.3—47.3 mm. *P. tenuirostris* is further distinguished, in the dark phase, by the uniformity of the gray of the under coverts of the wing, the shaft stripes and other heavy dark markings often present on these coverts in *P. griseus* being altogether wanting. In the extreme light phase of both species the under coverts of the wing are white, and therefore not diagnostic.

Mr. Ridgway's analytical key to *P. tenuirostris*[1] is not always adequate; the exposed culmen in short-footed examples (notably No. 9758 C. A. S.) is sometimes decidedly longer than the combined length of the first two divisions of the outer toe. The keys of Mr. Salvin and Dr. Godman are still more inadequate, the length of the wing[2] and absence of white on the under wing-coverts[3] being given as differential characters of the species.

Appended are the dimensions in millimeters of twenty-two males and twenty-two females—all from the ocean in the vicinity of Point Pinos, California.

	Sex	Wing	Tail	Culmen	Upper Mandible		Tarsus	Middle Toe and Claw
					Depth	Width		
Maximum	♂	290	90	35	9.6	16	51	63.5
Minimum	♂	266	81	31.7	8	14	46	58
Mean	♂	282	85	33.3	8.8	14.7	48.2	60.9
Maximum	♀	286	87	35	9.5	15.1	50.3	62.3
Minimum	♀	264	77	29.7	8	13.2	44.3	56.1
Mean	♀	274	84	33	8.7	14.4	48.2	59.5

The above measurements show a slight difference in the size of the sexes in favor of the males.

[1] Man. N. A. Birds, p. 62.
[2] Salvin, monograph, p. 370.
[3] Mon. Petrels, p. xlii.

Puffinus nativitatis *Streets:* Christmas Island Shearwater

Salvin—*Puffinus nativitatis,* 370, 389.
Godman—*Puffinus nativitatis,* xlii, 153, pl. 40.

Lord Rothschild and Dr. Hartert record without date a "♀ ad. at sea, 12° 5′ lat. N., 107° long. W."[1] I know of no other instance of a specimen having been captured within our bounds.

In three Laysan Island specimens (a female of May 17, a male of May 21, and an undated male) feather renewal appears to be at rest. Although apparently fully grown, the distal primary is somewhat shorter than the second in the female and one of the males. A like discrepancy has been observed in other shearwaters.

MEASUREMENTS (in millimeters)

No.	Sex	Wing	Tail	Culmen	Upper Mandible		Tarsus	Middle Toe and Claw
					Depth	Width		
18873	♂	247	90	32.5	9	13.5	44	50.1
5650[2]	♂	251	91	31	8.5	12.5	41.3	52
5649[2]	♀	258	88	30	8.7	13	41.9	48

Puffinus chlororhynchus *Lesson:* Wedge-tailed Shearwater

Plate 17

Coues—*Thiellus chlororhynchus,* II, 123, 142; *Thiellus sphenurus,* II, 122, 142.
Salvin—*Puffinus chlororhynchus,* 369, 372; *Puffinus cuneatus,* 369, 371.
Godman—*Puffinus chlororhynchus,* xl, 84, pl. 24; *Puffinus cuneatus,* xl, 76, pl. 22.

To Dr. Godman belongs the credit of having first suggested in print[3] that *Puffinus cuneatus* Salvin is a synonym of *Puffinus chlororhynchus* Lesson, the type specimens representing respectively the light and dark phases of a single species.

The series before me illustrates fairly well the variations shown in specimens from the Revilla Gigedo, Hawaiian, Kermadec, and Seychelle islands. Intergradation is complete throughout this series, there being no constant differences either in color or size.

[1] Nov. Zool., v. 9, p. 414.
[2] Stanford Univ.
[3] Mon. Petrels, pp. 79, 80.

I consider that Lesson's type (preserved in the Natural History Museum at Paris) and original description afford a better basis for determining the specific name of this species than Latham's description of his Pacific Petrel, upon which *Procellaria pacifica* Gmelin was founded.[1] "Length twenty-two inches" is in itself a sufficient discrepancy to disqualify Latham's description.

Although widely dispersed, the individuals of this species do not appear to be migratory, the different colonies apparently frequenting only the seas adjacent to their native islands.

The Galapagos Expedition, as stated in Mr. Gifford's notes, first encountered Wedge-tailed Shearwaters on July 23, 1905, in latitude 20° 59′ N., longitude 111° 57′ W. Only a few were seen then, but two days later they were common in latitude 19° 37′ N., longitude 111° 11′ W. Two that were shot on wing were devoured by sharks before they could be recovered from the water. The rookery on San Benedicto Island was visited on July 26, and was found to be in a flourishing condition. Although the season was advanced, no downy young were discovered; the eggs, however, as a rule were hard-set. In some instances two old birds without an egg occupied a burrow. The burrows were about four feet in length and rarely had more than one turn. As Clipperton Island was neared, these shearwaters became scarce. August 10 seven of the light phase, apparently superannuated birds, were found on the island—three in caves and four on the bank of the lagoon. They were the last individuals observed during the outward voyage. On the return voyage the first were seen on September 28, 1906, in latitude 7° 23′ N., longitude 97° 48′ W. Thereafter they were met with daily for nearly three weeks. They were most numerous on October 8 in latitude 14° 40′ N., longitude 109° 26′ W. The last one was left astern on October 18 in latitude 16° 55′ N., longitude 112° 55′ W.

The diary of Mr. Alexander Sterling Bunnell, who accompanied the Academy's Revilla Gigedo Expedition of 1903, contains the following notes on the San Benedicto colony:

May 15, 1903. Toward sunset the Wedge-tailed Shearwaters came by thousands from the ocean and down from the

[1] Cf. Mathews, Birds Austr., v. 2, pp. 79, 80.

cliffs, filling the air for half a mile, as high as the highest cliff, 900 feet. Their flight was flitting, bat-like, with an occasional sail. The whole concourse, with individual exceptions, moved as if it were a liquid, being stirred in various places. Now and then one uttered a low cat-like call. They were flying so thick and fast that they often bumped into one another. They did not light on the water and appeared to be doing nothing. Especially when we gave their cat-call or killed some, they came close to the boat, so close that we got all the specimens we wanted by batting them with the oar. The white-breasted ones were a very small proportion of the total number. As dusk came on their flight extended to their burrows high on the cliffs, but as night fell they flew near the water and spread out.

May 17. I climbed the main peak of the island, 900 feet in height. It is a cinder cone, composed entirely of powdery pumice caked by water and cut with a hundred steep, deep gorges, radiating from the summit on most sides, and broken by a cliff on the southeast. The whole cone was honeycombed with the burrows of these shearwaters and as I walked over it I heard their growls, which sounded like a combination of the north wind blowing through a knot hole, the wild cat's growl, and the screech owl's call. Every few steps I sank thigh deep into the burrows, raising a choking and blinding dust. A cloud of dust was always about the cone when the wind blew. At the mouths of the burrows the hardened ash was weatherworn into pillars, cupolas, terraces, giving to the rookery an appearance very much like the houses of cliff-dwellers. There were runways leading to each burrow marked with the birds' tracks. The direction of the tracks at the mouth often showed whether the birds were at home or abroad. If a cat-moaning is heard, two birds will be found in the burrow. A strong odor of musk was always apparent. The burrows extended in a horizontal direction, and were sometimes eight by seven inches at the opening and from four to eight feet in length, with a larger nesting cavity at the farther end. They were often four or five feet below the surface and usually had a slight turn. Some had a little grass or twigs in them. Few birds were seen on the cone outside the burrows. Occasionally one came in and sailed around, over and back, keeping close to the surface; then it

suddenly dropped and scurried into its burrow, raising a cloud of dust.

May 23. It is too early yet for eggs.

A series from San Benedicto Island illustrating the transition from the natal down to the definitive feathers would be especially instructive, showing whether or not the light phase is light-colored from birth, and the dark phase, dark-colored. It is apropos to note that Mr. William Alanson Bryan states that a nestling of the light Marcus Island bird is "a smoky lilac-gray over the back and top of the head, and very light pearl gray on the under parts, darkest on the abdomen,"[1] and that Mr. T. Iredale notes that the "down of the young was dark grey"[2] in the dark phase prevailing on the Kermadec Islands.

The Expedition specimens show some points worthy of special mention. A female (No. 748 C. A. S.), taken July 25, 1905, in latitude 19° 40′ N. and longitude 112° W., is immaculate white underneath from bill to crissum; none of the Hawaiian specimens I have handled are whiter (plate 17). Concealed portions of the dorsal feathers of this specimen are more or less washed with gray. In a moulting white-breasted male, obtained on October 4, 1906, the general aspect of the upper parts is quite gray. The throat in extreme examples of the dark phase is not grayer than in four specimens from the Kermadec Islands. As in certain other dark-bodied shearwaters, the dark gray browns with wear. The feathers of the lower parts are white basally in some birds of the dark phase and gray in others, the former condition indicating an approach toward the light phase. No. 116767 U. S. Nat. Mus., dark phase, Kauai Island, Hawaiian Archipelago, also has the feathers of the under surface white at the base, especially on the breast. *Puffinus knudseni* Stejneger[3] was founded on a white-breasted bird from Kauai Island, not on a dark-breasted one, as implied by Dr. Godman[4] in quoting from an article[5] by Mr. A. W. Anthony. Some specimens have gray filoplumes on the occiput, cervix, and sides of the head and neck.

[1] Occ. Papers B. P. B. Mus., v. 2, no. 1, p. 108.
[2] Emu, v. 10, p. 12.
[3] Proc. U. S. Nat. Mus., 1888, v. 11, pp. 93, 94.
[4] Mon. Petrels, p. 77; cf. Biol. Centr.-Amer., Aves, v. 3, p. 433.
[5] Auk, v. 17, pp. 250, 251.

Mr. Gregory M. Mathews remarks that the "all dark birds from San Benedicto Island are separable from any other form of *P. pacificus* [=*chlororhynchus*] by their more powerful bills."[1] Not one of the San Benedicto birds at hand has a bill as large as that of a male from the Kermadec Islands, which has the chord of the exposed culmen 44.1 mm., the depth of the upper mandible 12.2 mm., and the width 18 mm.

The Expedition collection contained fifty-five specimens. When outward-bound in 1905, fifteen were taken at sea on July 25, twenty-one from burrows on San Benedicto Island on July 26, two at sea on August 8, and three on Clipperton Island on August 10; when homeward-bound in 1906, fourteen were secured at sea between the 4th and 12th of October.

The specimens captured at sea on July 25 are in worn plumage with renewal commencing on the pileum, cervix, jugulum, and breast, and in some instances on the abdomen. Specimens taken from burrows on the following day are also in worn dress, but as a whole are more backward in their moulting. The August specimens are in about the same condition as the July ones. Those of October show advance both in wear and restoration; the primaries and rectrices, however, are still unaffected by the moult.

Inasmuch as specimens taken from burrows are often worn and faded, it becomes apparent that breeding stations can not be relied upon implicitly to furnish typical examples of geographic, or other, variations in color.

Seventeen males and thirty females of the Expedition afford the following measurements in millimeters:

	Sex	Wing	Tail	Culmen	Upper Mandible		Tarsus	Middle Toe and Claw
					Depth	Width		
Maximum	♂	309	148	41.2	11.5	17.2	48.2	62
Minimum	♂	289	129	36.6	9.5	13.9	41.4	52.2
Mean	♂	299	138	39.1	10.5	15.7	46.6	57.5
Maximum	♀	311	145	42.1	11.9	17.6	48.1	61
Minimum	♀	287	128	36.6	9.2	14.5	43.8	53
Mean	♀	298	138	38.9	10.3	15.7	46	57.2

Length and extent in flesh: One male, 444 mm., 978 mm.; one female, 430 mm., 980 mm.

[1] Birds Austr., v. 2, p. 84.

From the above, it seems that the average dimensions of the females do not fall short of those of the males.

A dozen eggs from San Benedicto Island are white, and vary in form from ovate to elongate ovate, and measure in millimeters: 58.4x41.5; 58.7x41; 59.4x38.5; 61x43.5; 61.7x40.6; 62x42; 62.5x41.5; 64x40.2; 64x42; 64.2x41.5; 64.5x39.3; 64.5x40.

Puffinus bulleri *Salvin:* Buller's Shearwater

Salvin—*Puffinus bulleri*, 369, 371.
Godman—*Puffinus bulleri*, xl, 81, pl. 23.

By far, Buller's Shearwater is the rarest shearwater in collections. Dr. Godman reports only six specimens in his monograph—five from New Zealand and one from California waters, the last, a female, shot by myself on the ocean near Point Pinos on November 6, 1896. Mr. R. H. Beck has since obtained fifteen off Point Pinos, more than doubling the number of specimens previously known to science. Unfortunately, his first specimen, secured in September, 1903, was destroyed in the Conflagration of April, 1906, along with the one captured by myself. Of the remaining fourteen, nine were collected for the Academy and five for the University of California. The University specimens are all males, and were taken in 1910—one on September 14, three on September 26, and one on October 13. The Academy specimens are of both sexes and were procured during two autumns, as follows: A female on September 2 and two males on November 4, 1907; a male on the 9th, a male on the 13th, and two males and two females on the 15th of October, 1909.

The breeding places of this Southern Hemisphere species and the route by which it reaches the vicinity of Point Pinos, California, are unknown.

Below are Mr. Beck's notes for 1907 and 1909.

1907. In February I returned to Point Pinos to spend a year endeavoring to replace in some degree the Academy's water bird collection destroyed in the great fire of 1906, giving

especial attention to the Tubinares. Not till September 2 did I see a Buller's Shearwater. On that day I went out on Monterey Bay three or more miles to the northeast of Point Pinos and found a large number of Black-vented and Sooty Shearwaters fishing. The weather was propitious, there being only a light breeze. As I rowed along from one flock to another, a Flesh-footed Shearwater flew over my head from behind, and was shot. A few minutes afterward, as I proceeded leisurely, being then about four miles north of Point Pinos, I saw a lone Buller's Shearwater fishing with a few Spanish mackerel. As the fish went down, the shearwater lit one hundred and fifty yards away from the boat. I rowed with all my might, but the bird arose out of range. As it circled, seventy yards distant, I fired, but merely caused it to settle for a few moments, only a single shot probably hitting it. As the bird shook its wings and rose, I fired both barrels and stopped it again. When I came up within long range, it started off once more, but this time I secured it.

On November 4 I went out seven or eight miles north of Point Pinos and finally reached the gathering of shearwaters I was looking for. There were about twenty thousand Sooty, two hundred or more Black-vented, and about thirty Cooper's Shearwaters. They were scattered about over considerable water, and as I approached one of the larger bunches I saw two Buller's Shearwaters fly around it and enter the bay. Further on I discovered one on the water apart from a flock of Sooty Shearwaters, and secured it. Another was seen sitting in the midst of a flock of Sooty Shearwaters. Another still was sitting close to two of these shearwaters. It decoyed to a dead bird thrown into the air, but unfortunately was missed with my first barrel, and escaped, my other barrel being out of commission. Later in the day I secured a second specimen of Buller's Shearwater from the concourse of shearwaters. I also obtained from it two Flesh-footed and a Slender-billed, the only ones noted.

On November 8, about four miles north of Point Pinos, a single Buller's Shearwater, in worn plumage, was seen flying about in search of food, but too far away to be secured.

1909. I spent the last four months of 1909 in collecting on the bay and ocean adjacent to Point Pinos. On October 9 I got out about four miles northeast of Point Pinos, and found a few Sooty and Cooper's Shearwaters in bunches on the water. The first flock of these shearwaters I neared rose out of gunshot range, and with them a Buller's Shearwater. They all flew north and appeared to settle in the far distance. I rowed in their direction and presently a Cooper's Shearwater flew past me, and shortly after, a Buller's, which I shot. An hour later I approached a flock of shearwaters on the water, but they rose when a hundred yards distant, and flew to the northward. With them were two Buller's Shearwaters. As the weather was not settled and as I was alone as usual in a rowboat I followed no further.

On the 13th of October, when I was out about four miles north of Point Pinos, a Buller's Shearwater came along, going south. It swung up twenty yards astern of the boat, and I shot it.

October 15 there was a low fog all day, and part of the time a drizzle. I went out about five miles northeast of Point Pinos and found a few Cooper's Shearwaters fishing about, and working out to sea. One Buller's Shearwater was seen flying with a couple of Cooper's Shearwaters, a few hundred yards outside the boat. Presently another Buller's came along, and I winged it. Another one appeared, and started after the wounded bird, which was swimming rapidly away. I tossed up a dead Bonaparte's Gull and then a Western Gull, and the flying bird swung back toward me, and I shot it. Later, two other Buller's Shearwaters came my way, and were secured. The flight of all these birds, in the light wind, was similar to the albatross flight, there being no flapping of wings as in Cooper's Shearwater, except when rising over the crest of a wave. Three of the four specimens taken had the generative organs slightly enlarged.

Comparison shows that No. 24302 Carnegie Museum (male, Mokokinou Islands, New Zealand, "1889") is identical in specific characters with the series obtained on the ocean off Point Pinos, California. The following is a blanket description of the fourteen Point Pinos specimens now extant:

Pileum and anterior part of cervix deep, or dark, mouse gray, forming a cap contrasting with the adjacent upper parts; lores and auriculars mouse gray, chiefly dark in tone, interrupted in a varying degree with white; usually a whitish mark just above the eye; posterior portion of cervix and sides of neck, the scapulars, interscapulars, and upper tail-coverts mouse gray or deep mouse gray, more or less varied with darker subterminal borders and grayish white edgings; rump deep mouse gray, relieved in most instances with paler edgings; jugulum, breast and abdomen immaculate white; line of demarcation on sides of neck and breast nebulated gray and white; sides white, in two specimens with indications of gray; flanks mouse gray, the feathers narrowly tipped with grayish white; general aspect of lower tail-coverts white, bordered and tipped with gray, the lateral feathers being varied with mouse gray, particularly on the outer web, and the partially concealed central ones being deep mouse gray, apically at least; primaries outwardly black, the shorter ones frosted with gray, and the inner webs of all extensively white; the secondaries, except innermost, mouse gray, margined with grayish white, and largely white on inner web; the innermost secondaries blackish brown, some of them tipped with grayish white; tertials blackish brown, more or less washed with gray and tipped with grayish white; lesser wing-coverts blackish brown; middle coverts blackish brown, the outermost sometimes mouse gray with paler edgings; greater coverts light mouse gray, margined with grayish white, the innermost blackish brown; alula and primary coverts black; lining of wings and axillaries white; inner edge of wing with a narrow broken border of mouse gray and blackish brown; two lateral rectrices mouse gray (or dark brown frosted with gray), tipped with grayish white; the other rectrices black.

In the majority of specimens gray filoplumes occur on the head and cervix. Two of the University of California males exhibit abnormal tail development, No. 18682 having fourteen rectrices (seven of them still in the sheath) and No. 18685 thirteen rectrices.

The moult of Buller's Shearwater does not appear to differ from that of other Southern Hemisphere shearwaters occurring off Point Pinos during the northern autumn.

MEASUREMENTS (in millimeters)

No.	Sex	Length	Extent	Wing	Tail	Culmen	Upper Mandible		Tarsus	Middle Toe and Claw
							Depth	Width		
9293	♂	460	985	296	126	40.4	10.4	13.4	47.6	61
9295	♂	465	980	297	132	40.4	10	13.6	50.1	61
15757	♂	.....	.....	285	123	43.1	10.6	13.5	49	58.9
15758	♂	.....	.....	298	130	42.7	10.7	14.2	49.8	63.2
16233	♂	493	1016	297	125	43.5	11	15.2	51	63.7
16235	♂	.....	.....	291	120	43	11.2	14.6	51	63.1
18682[1]	♂	483	991	298	129	43	11.2	15	48.9	61
18683[1]	♂	483	991	299	129	42.1	11	15.4	49.5	62.8
18684[1]	♂	483	1016	309	127	45	11.1	14.2	50	63.1
18685[1]	♂	483	1016	307	133	42	10.6	15	48.9	62.8
18686[1]	♂	476	991	291	126	41.9	10.8	13.5	48	62.1
24302[2]	♂	.....	.....	297	135	42.5	9.9	13.2	48	61
9294	♀	463	975	.....	119	41.5	10.1	14.5	48.1	61.9
16234	♀	470	991	293	125	40.7	10	13.7	50.3	62.8
16236	♀	.....	.....	303	137	43.1	10.6	14.5	49.5	61.7

Halocyptena microsoma *Coues:* LEAST PETREL

COUES—*Halocyptena microsoma,* I, 79, 90, V, 191.
SALVIN—*Halocyptena microsoma,* 346.
GODMAN—*Halocyptena microsoma,* XXXV, 6, pl. 3.

According to Mr. Gifford's notes, Least Petrels were first noted by the Expedition on July 10, 1905, in latitude 30° 35′ N. and longitude 117° W., and were last seen on July 21, 1905, in latitude 23° 32′ N. and longitude 113° 4′ W., none being observed in the vicinity of the Galapagos Islands or during the homeward passage. On San Benito Islands, Lower California, July 14, 15, 17, pairs were found at home among the rocks and, more rarely, under dead century plants. It was early for eggs; Mr. Beck, alone, was successful in the search, on the 15th obtaining in a rock pile a single fresh one, together with the female parent.

Like other short-legged storm petrels of the Northern Hemisphere, the Least Petrel is migratory, its fly-line apparently paralleling the coast from Lower California to Ecuador.

Feather renewal is dormant and feather disintegration active in the seventeen Expedition specimens. The greater wing-coverts are much darker in some of these specimens than in others, natal brown supplanting the pale grayish brown.

[1] Mus. Vertebr. Zool., Univ. Calif.
[2] Carnegie Museum; New Zealand.

MEASUREMENTS (in millimeters)

No.	Sex	Length	Extent	Wing	Tail	Culmen	Tarsus	Middle Toe and Claw
447	♂	.....	.....	122	52	11.3	20.3	18.9
448	♂	.....	.....	125	55	10.7	22	20.7
450	♂	.....	.....	119	51	11.4	21.4	19.3
451	♂	.....	.....	123	52	11.2	21.9	19.1
453	♂	.....	.....	121	53	11.2	21.3	18.5
454	♂	.....	.....	122	54	11.1	20	18.9
456	♂	.....	.....	120	55	11	20.1	18.6
459	♂	.....	.....	121	53	11.5	21	19
449	♀	.....	.....	129	58	11	21.6	19.5
452	♀	.....	.....	123	57	11.1	21.5	20.5
455	♀	.....	.....	125	52	11.2	20.2	20
457	♀	.....	.....	126	53	11.1	20.7	19.3
458	♀	.....	.....	127	54	10.7	20.1	17.8
460	♀	.....	.....	128	56	11.2	20.9	18.9
461	♀	.....	.....	122	55	10.8	21	18.5
462	♀	152	343	120	53	11	20.6	20
463	♀	.....	.....	125	55	11	20.3	19

The single egg, mentioned above, measures 25.4x19.5 mm. It is elliptical oval in shape, inclining to oval, and is dead white, with a very few dark specks, so minute and scattered as to be scarcely discernible.

Oceanodroma tethys (*Bonaparte*): Galapagos Petrel

Coues—*Procellaria tethys*, I, 80, 90, V, 192.
Salvin—*Procellaria tethys*, 343, 346.
Godman—*Procellaria tethys*, xxxv, 4, pl. 2.

Scarcely anything has been written concerning the Galapagos Petrel, and, as might be expected, the results of the Academy's two ocean expeditions add somewhat to the common stock of information. The known northern range of the species was considerably extended by both expeditions. During the one to the Galapagos Islands, individuals first made their appearance on July 21, 1905, in latitude 23° 32′ N., longitude 113° 4′ W., the position where the Black-footed Albatrosses parted company with the schooner *Academy*. On the following day, about a degree further south, a dozen specimens of the Galapagos Petrel were secured, and from this time forward, this petrel is prominent in Mr. Gifford's notes.

When homeward-bound, it was last chronicled by him on October 22, 1906, in latitude 17° 53′ N., longitude 114° 45′ W. During June, 1903, while on the Revilla Gigedo Expedition, Mr. Beck obtained numerous specimens at Banderas Bay, Mexico. In the Galapagos Archipelago, Mr. Gifford records the species for every month of the year except November, December, and March. Messrs. Snodgrass and Heller report[1] it for December, and Mr. Ridgway lists[2] two specimens taken by Mr. C. H. Townsend on March 1 in latitude 4° 22′ N., longitude 82° 3′ W. During the *Academy's* cruise south of the archipelago, in June, 1906, it was met with daily. Individuals were observed on the 11th in latitude 4° 25′ S., longitude 93° 30′ W., the most southerly bird-watching station of the Expedition. Capt. R. Paefsler has logged its occurrence in latitude 17° S., longitude 74° W., June 6, 1910; 18° S., 72° 5′ W., Feb. 15, 1912; 20° 6′ S., 70° 4′ W., Oct. 17, 1913.[3]

From the foregoing facts it would appear that the range of the Galapagos Petrel extends over the intertropical seas contiguous to the American west-coast.

In substance Mr. Gifford's Galapagos notes are as follows:

These storm petrels nest in holes in the cliffs and among the lava blocks on the south side of Tower Island, the rookery extending along the face of the cliffs for three quarters of a mile and inland for about two hundred yards. On September 15 Mr. Beck visited the rookery and found an addled egg and saw one of these petrels enter a nesting hole.[4] The genital organs of the specimens taken were medium-sized. In specimens obtained near Albemarle Island in April these organs were enlarged, indicating the advent of the egg-laying season. These petrels were also observed in the vicinity of Abingdon, Barrington, Bindloe, Brattle, Charles, Chatham, Cowley, Culpepper, Daphne, Hood, Indefatigable, James, Narborough, and Wenman islands, but were not numerous, except between the Equator and Tower Island on the 13th and 14th of September and northwest of Abingdon Island on the 23rd. There

[1] Proc. Wash. Acad. Sci., v. 5, p. 243.
[2] Proc. U. S. Nat. Mus., v. 19, pp. 657, 658.
[3] J. f. O., 1913, v. 61, pp. 42, 49; 1914, v. 62, p. 273.
[4] Cf. Condor, v. 4, 99.

were no flocks, however, not more than two or three being seen together. On all occasions these petrels were silent, even when following the schooner and picking up turtle fat in company with Dark-rumped Petrels. Their flight was butterfly-like, and more erratic than the flight of the Graceful Petrels. Galapagos Short-eared Owls are their great enemies on land, the remains of the petrels being often found in owl pellets. In life the bill, orbital ring, and feet are black and the irises dark brown.

Mr. Beck's label states that the egg, mentioned above, was found in a slight hollow in the soil under a lava block on the south side of Tower Island and that the nesting season had passed, although two or three hundred Galapagos Petrels were seen flying about over the nesting ground. He affirms that the identity of the egg is "sure." Nevertheless, a petrel egg taken without the parent bird is not above suspicion. The egg is ovate in form, inclining to elliptical ovate, and white, with a very few minute dark dots, so small and scattered as to be hardly perceptible. It measures 26.7 x 19.9 mm. So far as I am aware, no description of the egg of this species has appeared in the literature.

The ninety-two Expedition specimens of the Galapagos Petrel have the tail emarginated,[1] very much as in *Oceanodroma castro*. Many of the specimens have the tarsus decidedly longer than the middle toe and claw, which is likewise true in numerous specimens of *Oceanodroma melania*, these relative dimensions being unstable in the Thalassidrominæ—see tables of measurements under the different species. The usual point-of-wing-formula in the Galapagos Petrel and in *O. melania* is: primary 2>3>1>4. Obviously, the Galapagos Petrel is not a square-tailed, but a fork-tailed storm petrel. It is therefore transferred from the genus *Thalassidroma* to the genus *Oceanodroma*, the technical name of the species by this association becoming *Oceanodroma tethys*.

The tone of the brown of the greater wing-coverts varies considerably, being very pale in some specimens, and the lateral

[1] In his description of the species Mr. Salvin states that the tail is "slightly forked" (mon., p. 346), but in his key to the genera he states that the tail is "not distinctly forked" (p. 343).

lower tail-coverts and the base of the tail are more or less white.

Of the Expedition series, twelve specimens were taken on the 4th and 5th of January, four on April 24, sixteen between the 4th and 11th of May, twenty-six between the 7th and 18th of June, fifteen on the 22nd and 25th of July, six between the 1st and 14th of August, eight on the 1st, 2nd, and 15th of September, five on the 4th, 5th, and 12th of October. Although by no means complete, this series affords a fair clue to the moult of the species. In the January specimens feather renewal is practically at a halt. In an April bird the first and second primaries are not fully grown. The first primary is also backward in a bird of May 7, in one of May 10, and in three of June 18. According to some of Mr. Beck's labels, great enlargement of the sexual organs prevails during May and June, indicating the height of the breeding season in Galapagos waters. Most of the specimens obtained in July were undergoing a complete moult. As in the moulting of other petrels, the degree of advancement varies in different individuals. August and September specimens, as a whole, manifest further progress, while October ones, in most instances, show an abrupt decline in feather growth.

The dimensions in millimeters of fifty-four males and seventeen females are summarized in the subjoined table.

	Sex	Wing	Tail	Culmen	Tarsus	Middle Toe and Claw
Maximum	♂	143	66	13.8	23.7	21
Minimum	♂	130	54	11.4	20	18
Mean	♂	137	59	12.6	22	19.5
Maximum	♀	145	67	14	23.3	21.3
Minimum	♀	132	55	11.8	20.2	18.1
Mean	♀	137	59	12.7	21.8	19.7

No marked difference in the dimensions of the sexes is manifested in the preceding summary.

DETAILED MEASUREMENTS (in millimeters)

No.	Sex	Length	Extent	Wing	Tail	Fork of Tail	Culmen	Tarsus	Middle Toe and Claw
355	♂	170	410	143	65	9	13.7	23.1	20
359	♂	170	.....	134	60	8	12.7	21.3	19.1
361	♂	.....	.....	132	61	7	12.3	23.5	19.5
377	♂	165	400	138	59	9.3	12.2	23.7	20.7
378	♂	160	400	141	60	5	12.5	21.9	19.9
382	♂	165	380	134	59	7.7	12.2	21.1	19.9
383	♂	170	400	137	59	7.5	12.4	22	19.1
386	♂	167	400	138	61	11	13	21.3	19.8
390	♂	.....	.....	130	57	7	13	21	20
396	♂	163	400	142	56	6	13	22.3	19.4
401	♂	155	390	134	55	7	12	22.7	20
405	♂	167	396	137	65	7.5	12.4	21.6	20
406	♂	165	410	139	59	7.5	12.6	21.9	19.2
408	♂	.....	.....	134	55	7	12.4	23	19
410	♂	165	395	133	58	9	13.2	22.4	19.9
418	♂	.....	.....	136	61	9.7	12	21	20.1
430	♂	165	400	142	62	9	12.5	22.2	19.1
440	♂	165	400	138	57	11	12.9	20.4	18.6
441	♂	.....	.....	136	59	8.7	13	22	18
371	♀	.....	.....	138	60	5.5	11.8	20.2	19.5
380	♀	170	400	144	60	5.5	13.2	22.1	20.1
387	♀	165	390	134	55	6.8	12.9	22	20
389	♀	.....	.....	138	60	9.4	12.4	22.5	18.1
403	♀	.....	.....	134	56	5.2	12.4	21.2	20.4
435	♀	165	390	134	58	9	12.5	21.2	18.5
436	♀	166	397	140	58	6	13	22.6	21.3

Oceanodroma macrodactyla *W. Bryant:* Guadalupe Petrel

Salvin—*Oceanodroma macrodactyla,* 351.
Godman—*Oceanodroma macrodactyla,* xxxvi, 18, pl. 5A.

Our knowledge of the distribution of this species is very deficient. It was not met with on the high sea by either of the Academy expeditions. Whether it performs a migration or whether it breeds anywhere except on Guadalupe Island is wholly in question.

The two types of the species are in the museum of the Academy. They are the only specimens of the Academy's original bird collection that survived the Conflagration of April, 1906. The specimen referred to by Mr. Salvin in his monograph as one of the types was merely a paratype.[1] It was also in the Academy's collection, but was not saved.

[1] Cf. Bull. Calif. Acad. Sci., v. 2, pp. 278, 451.

In the types the dark neutral gray of the crown, occiput, and upper cervix forms a cap, contrasting with the deep neutral gray of the lower cervix and interscapulars.

Three downy young from the Carnegie Museum, taken by Mr. A. W. Anthony May 26, 1892, vary considerably in size and in plumage development. In No. 22239 the secondary natal down has appeared on the body and posterior portions of the neck, but is only partially developed. In No. 22240 the secondary natal down is well developed on these areas, and the primary natal down is worn on the lower parts, especially posteriorly. The chin and throat are nearly naked in each of the three specimens. In No. 22241 definitive feathers, concealed by the natal down, cover the body and contiguous portions of the neck. The white upper tail-coverts have appeared and the wings and tail are assuming definite shape. The head and anterior neck are still clothed with natal down. The color of the natal down in the three specimens is warm deep mouse gray, the distinct brownish cast perhaps due to museum deterioration.

Oceanodroma castro (*Harcourt*): HARCOURT'S PETREL

SALVIN—*Oceanodroma cryptoleucura*, 347, 350.
GODMAN—*Oceanodroma castro*, xxxvi, 15, pl. 5.

The Expedition, Mr. Gifford states, did not find these petrels numerous in the Galapagos Archipelago; never more than three or four were seen at one time. They were noted in the vicinity of Albemarle, Charles, Chatham, Cowley, Hood, James, Seymour, and Wenman islands during the months of January, February, May, June, July, August, and December. A small breeding colony was discovered on August 13, 1906, on Cowley Island, a steep tufaceous islet about two hundred feet in altitude, situate east of Cowley Mountain, Albemarle Island. Two hard-set eggs, with parent birds, were secured, also an egg with a dried embryo. Mr. Beck's labels furnish the following particulars concerning them: One of the eggs with living embryo was deposited in a slight hollow in the soil of a small cave in a hillside amongst "lava boulders;" the other was placed on a little soil under a large "lava boulder" on a hillside. The egg with the dead embryo was found in a slight

hollow in the soil at the end of a small cave in a hillside. Seven young birds in various stages of down were obtained in similar situations.

Immediately south of the archipelago, Mr. Gifford records these petrels daily from the 6th to the 12th of May, 1906. On the 8th twenty were seen. Several were taken about 2 P. M., and the stomachs of some of them contained considerable food. All were in good plumage and had partially enlarged sexual organs. During a cruise south of the archipelago, nearly a month later, these petrels were met with again. When captured, they eject an orange-colored oil. In no instance were they heard to utter a note.

On the home voyage Mr. Beck shot a male (No. 496 C. A. S.) on November 9, 1906, in latitude 30° 30′ N., longitude 130° 55′ W., a position favorable for the occurrence of birds breeding in the Hawaiian Islands.

According to Mr. Gifford, Harcourt's Petrel and the Galapagos Petrel can be distinguished on wing by the difference in size and by the shape of the white patch at the base of the tail, this patch in the Galapagos Petrel forming an isosceles triangle and in Harcourt's Petrel a sort of band.

On the eastern side of the Atlantic, this petrel has been found on more than one occasion north of its breeding range. When its life-history is better known, it may be revealed that it has a migration northward after the breeding season.

The usual point-of-wing-formula is: primary $2>3>1>4$.

In life the bill, feet, and orbital ring are black (slightly brownish in young birds) and the irises dark brown (*Gifford*).

The seven nestlings show the transition from the natal down to the definitive feathers. In No. 520, female, the primary natal down is much worn and definitive feathers are making their appearance on the breast and scapulars, and the upper tail-coverts are emerging. The throat is quite bare in this specimen and in the following one. No. 519, female, is further along. Hidden beneath the natal down, definitive feathers are developing on the lower jugulum, breast, flanks, and upper surface of the body. The white upper tail-coverts are becoming prominent, and the wings and tail are taking form. No. 518, male, is a step in advance. The wings and tail are more developed,

and exposed definitive feathers dominate the pileum. The lower tail-coverts have appeared, definitive feathers have invaded the posterior cervix, and the throat and sides of head are being clothed. No. 517, female, manifests further progress. The wings and tail are beginning to be visible through the natal down, the region below the eyes and the sides of the body are covered with definitive feathers, and the axillaries and under coverts of the wings have broken from their sheaths. In No. 516, female, growing definitive feathers hide the skin on the throat and lores, and the wings and tail have lengthened and are freer from down. No. 515, male, has thrown off most of the natal down. The abdomen, however, is still hidden by it, and conspicuous remnants adhere to the occiput and cervix. No. 514, male, still carries some remains of natal down on the occiput, lower breast, abdomen, and under tail-coverts. The outer webs of the longer tertials are silvered with gray and edged with grayish white. In all the specimens the natal down is mouse gray, darkest in tone on the concealed secondary down.

The twenty-eight adult Expedition specimens were taken as follows: Three on the 4th and 5th of January; fifteen on the 8th, 9th, and 10th of May; four on the 16th and 18th of June; five at the breeding station on the 13th of August; one on the 9th of November. Although very deficient, this series sheds some light on the moult. Four of the fifteen May specimens have slight and irregular feather growth in progress, involving a rectrix in one instance. In two of the June specimens upper tail-coverts are being replaced. Three of the August specimens are renewing upper tail-coverts and a fourth two rectrices and some of the under tail-coverts and a little of the body plumage. The November specimen is replacing a rectrix and feathers on the breast and abdomen and in the lower tail-coverts. In the January specimens renewal is apparently quiescent.

Measurements (in millimeters) of Specimens obtained in Galapagos Waters

No.	Sex	Length	Extent	Wing	Tail	Fork of Tail	Culmen	Depth of Upper Mand.	Tarsus	Middle Toe and Claw
487	♂	190	470	154	69	7.1	16	5.3	21	24
490	♂	.....	.....	148	65	9	15.5	5	20	21.5
491	♂	190	465	155	73	12.7	15.6	5.1	20.5	23.3
494	♂	200	470	158	69	8	15	5.1	21.7	22.8
497	♂	200	475	160	72	6.3	15.5	5	21.6	24.5
499	♂	195	465	151	63	6	15	4.9	20.6	21.8
500	♂	190	468	160	72	9	15.2	5.2	20	22
506	♂	.....	.....	160	69	8.8	15	5	21.2	23.9
507	♂	195	465	160	69	7	14.3	5.1	19	20.1
509	♂	205	470	157	69	9	16	5.4	21.4	24.6
510	♂	190	455	152	66	6.1	14	5	21.3	23.5
512	♂	205	480	160	74	8.7	15	5	21	23
513	♂	.....	.....	154	65	5.5	15.3	5.6	22	23.4
485	♀	195	460	156	70	3	15.6	5.1	21.5	22.8
486	♀	190	455	156	71	4.5	15.5	5	19	21
488	♀	205	485	166	73	9	16	5	21.8	23
492	♀	205	485	162	74	12.5	16	4.5	20.7	23
493	♀	200	465	154	70	5.5	16	5.3	20.7	22.3
495	♀	190	460	156	69	6.3	15.4	4.8	20.8	20.8
498	♀	.....	.....	160	79	11.1	16	5.1	21.5	22
501	♀	198	473	157	72	8.9	14.1	5	21	22.1
502	♀	.....	460	154	69	9.3	15.5	5.2	21.5	23.1
503	♀	195	470	155	70	6	15	4.6	21.8	22.5
504	♀	.....	.....	165	74	11.1	16.3	5	22.4	25
505	♀	.....	.....	156	67	8.7	16	5	22.1	23.7
508	♀	195	465	157	71	4	16	5.3	20.8	22.2
511	♀	195	455	152	65	7.5	15.5	5.1	21	23.5

Inasmuch as Galapagos specimens exhibit considerable individual variation in the dimensions of the bill and in the depth of the fork of the tail, it is evident that long series from the Eastern Atlantic, Galapagos, and Hawaiian islands must be compared before it can be determined whether or not this species is subject to geographic variation in size.[1] Furthermore, the depth of the fork of the tail is an unreliable measurement, unless the rectrices are fully grown and unworn.

No. 496 C. A. S., male: Wing 153 mm.; tail 66.3; fork of tail 6; culmen 14.3; depth of upper mandible 5; tarsus 21.1; middle toe and claw 21.8.

The two eggs of certain identity, referred to above, are white, more or less discolored through incubation. One of them is ovate in form, inclining to elongate ovate, and the other is elliptical ovate. They measure respectively: 32.4 x 23.4 mm.; 33 x 21.4 mm.

[1] Cf. Nichols, Auk, 1914, v. 31, pp. 388-390.

Oceanodroma leucorhoa (*Vieillot*): Leach's Petrel

Coues—*Cymochorea leucorrhoa,* I, 76, 90.
Salvin—*Oceanodroma leucorrhoa,* 347, 348; (?) *Oceanodroma socorroensis,* 352; (?) *Oceanodroma monorhis,* 347, 356, pl. 2.
Godman—*Oceanodroma leucorrhoa,* xxxv, 8, pl. 4; *Oceanodroma beali,* xxxv, 11; *Oceanodroma beldingi,* xxxv, 12; (?) *Oceanodroma kædingi,* xxxv, 13; (?) *Oceanodroma monorhis,* xxxvi, 32, pl. 9.

Enlargement of the synonymy of *Oceanodroma leucorhoa* has been in vogue of late years. Individual variation and geographic variation in size have been given binomial names and treated as species. In order to elucidate these matters I have assembled for comparison a series of one hundred and seventy-one specimens; thirteen from Bird Rock, Gulf of St. Lawrence, one from off Cape Verde, Africa, ten from Sitka Bay, Alaska, including the types of *Oceanodroma beali* Emerson, six from the coast of Oregon, including the type of *Oceanodroma beldingi* Emerson, eight from Humboldt County, California, six from Southeast Farallon Island, one from Pigeon Point, California, the type and twenty-seven paratypes of *Oceanodroma kaedingi* Anthony, seventy-seven *Oceanodroma socorroensis* C. H. Townsend, mainly from Los Coronados and San Benito islands, Lower California, and twenty-one Expedition specimens taken at sea south of the Galapagos Islands and during the return voyage.

In considering color values in fuliginous storm petrels, it should always be kept in mind that the plumage in life soon loses its bloom and browns with wear, and that museum specimens fade with time, becoming valueless so far as nice distinctions of color are concerned.

The tables of measurements, given beyond, prove that the minimum dimensions of the Bird Rock specimens are completely overlapped by the maximum dimensions of the Sitka Bay specimens. In consequence the only character advanced in support of *"O. beali"* fails, the Alaskan bird not being "of uniformly smaller size" than the Atlantic one.

"O. beldingi" is described as similar to *"O. beali,"* "but decidedly grayer, and averaging notably smaller in length of wing and tail." Seven July specimens from Oregon and Humboldt County, California, are not grayer than the types of *"O.*

beali," and the accompanying table of measurements shows no notable superiority in dimensions in favor of the Alaskan birds. *"O. beldingi,"* therefore, has no claim to recognition.

Compared with the northern specimens, the six Farallon specimens exhibit no marked disparity in size. They average decidedly larger, however, than the series of *"O. kaedingi."*

The breeding grounds of *"O. kaedingi"* have not been reported. The specimens, referred to above, were taken at sea off Lower California; twenty-five of them, including the type, in latitude 31° N., longitude 117° W., July 25, 1897, and three in latitude 28° 35′ N., longitude 118° 30′ W., July 18, 1897. The plumage of all has suffered from wear, and the depth of the fork of the tail has thereby been diminished, rendering that dimension unreliable. As shown by the tables of measurements, the various dimensions intergrade with the minimum dimensions of the northern birds, the alleged specific characters proving inconstant. Besides averaging smaller, the *"O. kaedingi"* specimens seemingly average darker than the northern ones. The white of the upper tail-coverts is greatly restricted in several of them. In three it is reduced to two lateral traces. Two others are intermediate, and connect the two phases, which I believe exemplify dichromatism and not individual variation. A tendency to this bicoloration is manifested in some of the specimens from the other regions, the white being conspicuously interrupted by the dark central coverts.

Of the forty-three Expedition specimens of *"O. socorroensis"* obtained on July 14, 15, 17, 1905, on San Benito Islands, not one has any indication of white on the upper tail-coverts. Mr. Adriaan Van Rossem states that on Los Coronados Islands, late in June, 1913, "the majority of birds showed at least a trace of white, while of those taken August 13 of the present year [1914] only about one in four showed the above mentioned character."[1] Specimens with the upper tail-coverts extensively white intergrade with the darkest concolor specimens, and also are apparently indistinguishable from examples of *O. leucorhoa* from the north. As in the *"O. kaedingi"* series, I attribute the dual style of coloration to dichromatism. The absence of a dark phase on the Atlantic indicates a geo-

[1] Condor, v. 17, p. 78.

graphic distribution in the supposed dichromatism. Such distribution is well illustrated in *Puffinus chlororhynchus.* According to the tables of measurements, the dimensions average greater in the Los Coronados than in the San Benito specimens.

Dr. Godman has established the identity of *"O. socorroensis"* with *Oceanodroma monorhis* (Swinhoe).[1] It is significant that *O. leucorhoa* and *"O. monorhis"* are reported for the Asiatic coast.

In short, the material under consideration evidences that *"O. beali"* is based upon geographic variation in size (the dimensions averaging less than in Atlantic specimens), *"O. beldingi"* upon individual variation, *"O. kaedingi"* upon geographic variation in size (the dimensions averaging less than in specimens from Middle California, Oregon, and Alaska), and *"O. socorroensis"* upon dichromatism. However, before a final conclusion is reached concerning *"O. kaedingi"* and *"O. socorroensis"* (=*"monorhis"*), an extensive series of specimens of these supposed species, in new plumage and with nasal tubes undistorted, must be collected and compared with fresh northern specimens. In the meantime I have included the two names, with a question, in the synonymy of *O. leucorhoa,* leaving to the future the attempt to rescue them from limbo.

The usual point-of-wing-formulas, throughout the entire series, are: primary 2>3>1>4 and 2>3>4>1, the former predominating. The extreme base of the lateral rectrices is white in most of the specimens before me having white upper tail-coverts. Certain specimens display as much white on the lower tail-coverts as do some examples of *O. castro.* No. 473 C. A. S., white upper tail-coverts, November 15, has a light patch on the lining of the wings, resembling that in *O. homochroa.* Nos. 468 and 472 C. A. S. (both with white upper tail-coverts) have indications of such a patch. In No. 472 the dark tips of the white upper tail-coverts are as broad as in several *O. castro,* but are dark gray instead of black. The line of demarcation between the gray and white is not oblique in all specimens. The wing-bar generally penetrates further into the lesser coverts than it does in *O. castro.* Furthermore, in that species the dark central upper tail-coverts, usually present in *O. leucorhoa,* ap-

[1] Mon. Petrels, p. 33.

pear to be absent. At the point of nearest approach the two species may be readily distinguished as follows:

O. leucorhoa	*O. castro*
Tips of upper tail-coverts more or less dark gray, becoming white with wear.	Tips of upper tail-coverts black.
Lateral rectrices not definitely white at base for nearly an inch.	Lateral rectrices definitely white at base for nearly an inch, or more.

Eight *"O. monorhis"* specimens from Los Coronados Islands (Nos. 5257-5264, coll. J. Grinnell, Aug. 6, 1902) and one from San Benito Islands (No. 22498 Carnegie Mus., July 14, 1897) are in natal down. Most have reached the stage where the secondary down has emerged on the upper and lower parts of the body and posterior portions of the neck. In color the primary down is hair brown (darkest on the San Benito specimen) and the secondary down chaetura drab. In a specimen from Humboldt County, California (No. 16718 Mus. Vertebr. Zool., Univ. Calif., Sept. 4, 1910), the breast and abdomen are still clothed with the dark secondary down, concealing the definitive feathers. On the upper parts of the body and on the occiput vestiges of the dark secondary down still remain. Another specimen from the same locality (No. 16719 Mus. Vertebr. Zool., Sept. 4, 1910) retains the dark secondary down on the abdomen. In these two specimens the definitive feathers are not as brown as in the adults from the same locality, but are fairly matched by later autumn specimens taken at sea off the California coast.

The material at hand exhibits no exceptional features in the moult. In July specimens from Humboldt County, California, there are no growing feathers, which is also true, with one exception, in July *"O. monorhis"* specimens from the San Benito Islands. Feather growth is likewise in abeyance in the specimen from Pigeon Point, California, May 7, and in five of the six June specimens from Southeast Farallon Island. The other Farallon specimen, June 18, is renewing upper tail-coverts and feathers of the breast. Three belated June specimens taken just below the Galapagos Islands are also moulting, one of them, at least, undergoing a complete rehabilitation of plum-

age. The majority of the specimens obtained at sea between the 5th and 9th of October are in full moult. In three of eight specimens secured on the 15th and 19th of November renewal is still in progress.

During the Expedition's visit to the petrel colonies of the San Benito Islands, on the 14th, 15th, and 17th of July, 1905, five fresh eggs of the "Socorro Petrel" were obtained from deserted burrows of Cassin's Auklets. The burrows were situated in earthy spots, and were about three feet in length and had one or two turns. The egg in each case was deposited on the bare ground at, or near, the end of the burrow. The season was apparently not far advanced, for pairs without an egg were occupying burrows. The duties of incubation were shared by both sexes; in two instances the male was setting and in three the female.

The last captures of the southward voyage (a female and six males) were made on July 22, about latitude 22° 25′ N., longitude 112° 40′ W. In one of the males the upper tail-coverts are white and in the female and the other males they are dark. All exceed the size ascribed to *"O. kaedingi."*

During a cruise below the Galapagos Islands, three specimens, having white upper tail-coverts and dimensions corresponding with the larger northern specimens, were shot on June 11, 1906, in latitude about 4° 20′ S., longitude 93° 30′ W. On both the Atlantic and Pacific this species appears to extend its exodus-migration into the Southern Hemisphere.[1]

On the homeward voyage in 1906 eighteen specimens with white upper tail-coverts were taken as follows: Five, October 5, latitude 14° 28′ N., longitude 107° W.; three, October 8, latitude 14° 40′ N., longitude 109° W.; two, October 9, latitude 14° 11′ N., longitude 109° 20′ W.; three, November 15, latitude 33° 7′ N., longitude 134° W.; five, November 19, latitude 35° 40′ N., longitude 133° 14′ W. With one exception, none exhibits the dimensions of the *"O. kaedingi"* series.

[1] Auk, 1902, v. 19, p. 293; Nicoll, Ibis, 1906, p. 667; Murphy, Auk, 1915, v. 32, p. 170.

MEASUREMENTS (in millimeters)

ATLANTIC SPECIMENS

No.	Locality	Sex	Wing	Tail	Fork of Tail	Culmen	Tarsus	Middle Toe and Claw
9687[1]	Bird Rock, Gulf of St. Lawrence...	♂	161	84	22	15.9	23.1	23.1
9688[1]	do.	♂	159	73	17	16	24	23
9690[1]	do.	♂	157	79	18	17	23.8	23.9
9696[1]	do.	♂	163	84	24	16	24.5	24.8
9697[1]	do.	♂	158	78	19	16	23.7	24.5
9698[1]	do.	♂	155	76	18	17	25	24.5
9699[1]	do.	♂	156	82	17	16.3	22.7	24.5
9700[1]	do.	♂	159	80	20	16	24	24.8
9689[1]	do.	♀	165	82	24	17	23.8	23.3
9691[1]	do.	♀	162	82	19	16.8	23.9	25
9692[1]	do.	♀	166	91	24	17	22.9	23.9
9701[1]	do.	♀	155	77	18	16.6	24.8	24.4
111718[2]	do.	♀	160	80	18	16.3	23.8	24.8
24478[1]	Off Cape Verde, Africa.....	♀	153	73	20	17.7	23.4	25
	Average...	....	159	80	19	16.5	23.8	24.2

PACIFIC SPECIMENS

"O. beali" (coll. J. Grinnell)

No.	Locality	Sex	Wing	Tail	Fork of Tail	Culmen	Tarsus	Middle Toe and Claw
1138	Sitka Bay, Alaska	♂	148	73	18	15.6	22.8	24
1307	"	♂	150	75	20	16	21.1	23
1309	"	♂	152	76	21	14.4	22.3	22.9
1310	"	♂	152	78	20	16.7	23.4	25
1437	"	♂	160	82	22	16	23.9	25.2
1440[3]	"	♂	156	78	20	16	22.5	24.1
1441	"	♂	160	78	18	16.1	24	24.8
1311	"	♀	150	74	17	15.1	23.4	24
1438[3]	"	♀	152	77	19	16.1	23.8	23
1439	"	♀	162	81	22	16.4	24	25
	Average...	....	154	77	19	15.8	23.1	24.1

[1] Carnegie Museum.
[2] U. S. National Museum.
[3] Types of *"O. beali."*

"O. beldingi"

No.	Locality	Sex	Wing	Tail	Fork of Tail	Culmen	Tarsus	Middle Toe and Claw
53 [1]	Netarts, Ore.	♂	154	77	20	14.8	23.1	24
54 [1]	"	♂	149	74	20	16	22	22.9
1261 [2]	Three Arch Rocks, Ore.	♂	152	76	17	14.8	23.1	22.6
1264 [2]	"	♂	156	78	20	15.6	24.4	23.8
1350 [2]	"	♂	154	75	17	15	22.1	22.3
18820	Humboldt Co., Calif.	♂	152	74	16	15	21.2	24
13 [1]	Netarts, Ore.	♀	155	76	18	16	22.4	23.9
21426 [3]	Humboldt Co., Calif.	♀	160	75	16	15	23	24
21427 [3]	"	♀	161	82	21	15.3	23	23
21428 [3]	"	♀	156	74	18	15.4	23	24
21429 [3]	"	♀	159	76	19	15.9	23	24.3
	Average	....	155	76	18	15.3	22.7	23.5

Middle California Specimens

No.	Locality	Sex	Wing	Tail	Fork of Tail	Culmen	Tarsus	Middle Toe and Claw
18012	S. E. Farallon I.	♂	153	71	17	16	23.4	23.6
18052	"	♂	144	71	16	15.1	22	22.3
18013	"	♀	154	79	21	16.8	23	25
18014	"	♀	150	74	20	15.5	21.9	24.4
18053	"	♀	149	75	20	14.9	22	24
18103	"	♀	156	71	17	16.4	22.3	25
7090 [3]	Pigeon Point, Calif.	♂	151	76	17	15.4	22.8	23
	Average	....	151	73	18	15.7	22.4	23.9

[1] Coll. H. T. Bohlman; No. 53 type *"O. beldingi."*
[2] Game Department, Oregon.
[3] Mus. Vertebr. Zool., Univ. Calif.

"O. kaedingi" (Carnegie Museum)

No.	Locality	Sex	Wing	Tail	Fork of Tail[1]	Culmen	Tarsus	Middle Toe and Claw
22210	28° 35′ N., 118° 30′ W..	♂	151	63	10.6	15	21.5	21
22212	"	♂	143	66	8.7	14.7	20.9	21.3
22213	31° N., 117° W.....	♂	145	69	14.6	14.4	19.7	20.8
22214	"	♂	145	69	13	13.5	21.5	21
22215	"	♂	145	71	10	15.3	21	21
22216	"	♂	145	61	10	14.5	20.4	21.5
22217	"	♂	146	65	13	14	20.4	20.1
22219[2]	"	♂	151	71	15	14.4	20.8	19.8
22221	"	♂	147	69	14	14	20.3	22
22222	"	♂	149	63	12	13	21	20.9
22223	"	♂	144	63	13	14	20	21.7
22225	"	♂	147	68	15	13.5	21.1	20.9
22226	"	♂	147	70	15	14	20.3	21.1
22228	"	♂	144	66	14	14.9	20	21.2
22230	"	♂	147	70	12	14.9	21.2	22.4
22231	"	♂	149	66	17	15	20.9	21.5
22232	"	♂	147	66	11	14.8	20.5	20.8
22236	"	♂	146	69	16	14.7	21.8	21.4
22237	"	♂	146	68	13	....	20.6	21.7
22238	"	♂	143	66	15	14.2	20.8	21
22211	28° 35′ N., 118° 30′ W..	♀	147	64	13	14.9	20.6	21.7
22218	31° N., 117° W.....	♀	152	73	13	14.8	21.3	21
22224	"	♀	146	65	11	14	21	20.3
22227	"	♀	144	73	12	14	21.5	21.9
22229	"	♀	149	65	12	15	21.7	22.1
22233	"	♀	149	69	14	14	19.3	19.2
22234	"	♀	151	74	16	14	20.3	20.4
22235	"	♀	148	69	12	14.3	21	20.9
	Average.....	....	147	67	13	14.36	20.76	21.09

[1] Rectrices much worn.
[2] Type of *"O. kaedingi."*

"O. socorroensis," Los Coronados Islands

No.	Sex	Wing	Tail	Fork of Tail	Culmen	Tarsus	Middle Toe and Claw
22421 [1]	♂	157	80	20	16.7	22	23
22422 [1]	♂	147	75	20	16	22.2	22.5
22426 [1]	♂	155	79	19	15.5	22.8	24
22431 [1]	♂	152	80	22	15.6	21.6	23.4
22436 [1]	♂	162	81	22	16	23.5	24.1
22443 [1]	♂	158	78	21	15.5	22.5	23.3
22447 [1]	♂	154	80	20	17.5	22.1	22.8
5246 [2]	♂	150	70	19	15	23	23.8
5247 [2]	♂	155	74	22	16.9	23	24
5253 [2]	♂	157	78	25	16.7	23	25.5
5254 [2]	♂	149	73	22	15.3	22.4	23.8
22423 [1]	♀	164	81	20	16.9	23.2	25
22428 [1]	♀	156	80	22	16	23	23.3
22442 [1]	♀	162	80	20	16.8	23.5	23.8
5245 [2]	♀	152	73	21	16	21.6	23.1
5248 [2]	♀	157	79	23	16.3	23	24.5
5250 [2]	♀	154	74	23	15.8	21	24
5251 [2]	♀	155	76	19	16	22.2	25.4
5252 [2]	♀	155	79	22	16	22	23.3
5256 [2]	♀	159	82	24	15.8	23	23.8
Average.....		155	77	21	16.1	22.5	23.8

[1] Carnegie Museum.
[2] Coll. J. Grinnell.

"O. socorroensis," San Benito Islands

No.	Sex	Wing	Tail	Fork of Tail	Culmen	Tarsus	Middle Toe and Claw
521	♂	153	66	23	17	23.1	23.8
522	♂	155	76	22	16	21.6	22.5
523	♂	149	70	18	15.5	22.5	23.2
527	♂	145	65	17	15	22.7	22.1
530	♂	150	72	21	15.9	22.5	22.8
533	♂	153	72	22	15.3	22.8	23
535	♂	153	75	19	15.9	22.3	22.3
537	♂	150	72	19	15.2	21.6	23
539	♂	152	73	18	15	22	22
542	♂	150	70	18	15.9	23.5	23.3
545	♂	156	77	21	15.9	23	23.3
548	♂	151	78	23	16	22.5	23.7
554	♂	148	79	22	15.7	22	23.2
555	♂	143	72	19	15.4	22	21.5
558	♂	146	75	..	15.5	21	23
559	♂	151	74	25	15	22.2	22.7
560	♂	153	75	18	16	22.6	21.9
563	♂	150	76	21	15.5	23	24
565	♂	151	78	24	15.9	21.1	22.5
566	♂	154	82	26	16	21.2	22
567	♂	151	70	18	16	21.5	24.2
568	♂	155	79	22	15.5	21.7	24
569	♂	147	76	19	16	22.2	23
570	♂	151	69	18	16	21.9	22.4
573	♂	153	74	19	15.5	23.5	25
22462 [1]	♂	152	74	20	15.6	22.5	21.8
22497 [1]	♂	144	71	17	15.1	21	21
528	♀	152	77	22	16.8	22.4	22
529	♀	159	77	21	15.1	23.5	24
532	♀	155	78	21	15.5	22	23
536	♀	153	76	18	15.8	23	23
538	♀	153	77	19	16.5	24.1	24.5
540	♀	161	80	23	16	23	22.8
544	♀	152	76	19	16.3	22.9	24
546	♀	152	79	22	14.7	22.1	22.7
547	♀	154	79	24	16.5	23	24
549	♀	156	77	18	16.2	21.9	23.1
550	♀	152	72	19	15.1	22	23.2
553	♀	153	73	19	16	23	22.6
556	♀	152	77	19	15.2	21.8	21
561	♀	158	76	20	15.5	21.7	23.8
562	♀	158	78	18	16	23.3	24.4
564	♀	155	78	18	15.3	22	23
571	♀	151	78	21	15.7	22	23.8
572	♀	151	77	20	15.8	21.5	21.5
Average.	.....	152	75	20	15.7	22.3	22.9

[1] Carnegie Museum.

"O. socorroensis," at Sea

No.	Locality	Date	Sex	Wing	Tail	Fork of Tail	Culmen	Tarsus	Middle Toe and Claw
526	30° 40′ N., 117° W..	July 10	♂	151	69	18	15.4	23	22
543	"	"	♂	150	74	18	15.7	22.6	24
551	"	"	♂	153	78	19	17	23.3	23.3
557	"	"	♂	155	80	20	15.2	22.9	23.4
524	22° 30′ N., 112° 39′ W.....	July 22	♂	154	73	20	15	21.7	22.9
534	do.	"	♂	155	74	19	14.1	22	24.3
552	do.	"	♀	154	75	19	15	22.7	23
525	22° 25′ N., 112° 40′ W.....	"	♂	152	71	....	14.6	21.1	22.9
531	do.	"	♂	144	74	21	15.3	21.5	23
541	do.	"	♂	152	74	19	16	22	24.1
470[1]	do.	"	♂	152	79	17	15.8	23.1	24.2

Miscellaneous Specimens, at Sea[2]

No.	Locality	Date	Sex	Wing	Tail	Fork of Tail	Culmen	Tarsus	Middle Toe and Claw
484	4° 20′ S., 93° 30′ W.	June 11	♂	150	76	....	17	22.3	25.7
489	"	"	♂	153	73	....	16.5	23.9	24.3
482	"	"	♀	156	77	16	16.5	22.7	24.5
465	14° 28′ N., 107° W.	Oct. 5	♂	145	77	17	15.5	23.3	24.9
469	"	"	♂	145	75	17	16.5	22.9	24
464	"	"	♀	154	86	21	16.2	23.4	24.6
467	"	"	♀	147	78	19	15	22.7	25.3
475	14° 40′ N., 109° W.	Oct. 8	♂	155	70	....	16	23.1	24.5
483	"	"	♂	146	....	....	14.4	20.1	21.6
473	33° 7′ N., 134° W.	Nov. 15	♂	163	84	21	16	23	25.1
480	"	"	♀	160	81	20	16.2	24.4	25
474	35° 40′ N., 133° 14′ W.	Nov. 19	♂	157	82	19	16	23	24.5
478	"	"	♂	158	79	18	16.6	25	27
468	"	"	♀	155	75	17	15.6	23.3	25

The five eggs from the San Benito Islands are of an ovate form, varying to elliptical ovate, and are white, marked with a few scattered reddish specks; two also have an indistinct zone of reddish dots and specks and one has a cap of these markings. The measurements in millimeters are respectively: 29 x 21.5; 30 x 22; 30 x 23.5; 30.2 x 23.8; 31.5 x 24. A later egg from Southeast Farallon Island is similarly, but more distinctly marked, particularly its cap. It is of an ovate form, and measures: 31 x 23.4 mm.

[1] Upper tail-coverts white.
[2] Upper tail-coverts of all the specimens white.

Oceanodroma homochroa (*Coues*): Ashy Petrel

Coues—*Cymochorea homochroa*, I, 77, 90.
Salvin—*Oceanodroma homochroa*, 347, 355.
Godman—*Oceanodroma homochroa*, xxxvi, 29, pl. 8.

No specimens of the Ashy Petrel were secured by the Expedition. How far south the species ranges has not been ascertained. The most southerly occurrence known to me is that of a female (No. 6167 Mus. Vertebr. Zool., Univ. Calif.) in the vicinity of San Clemente Island, California. This bird came aboard the U. S. S. *Albatross* at night on April 8, 1904, and was captured by Mr. Loye Miller. So far as I am aware, there have been no captures north of Point Reyes, the known range of the species extending along the California coast between latitude 33° and 38° N. It has long been a matter of record that this petrel has bred on San Miguel Island. Recently Messrs. Howard Wright and G. K. Snyder have taken four eggs and a nestling with the parent birds on Santa Cruz Island.[1] Off Point Pinos, Mr. Beck has obtained it during its migrations; his latest autumn record is November 4. Southeast Farallon Island, as of old, appears to be the breeding stronghold of this species. Mr. Arthur L. Bolton informs me that he found it more abundant on June 19, 1911, than during early July, 1896, when he accompanied me on a trip to the island, the stoppage of the egg traffic[2] apparently resulting in an increase of population.

Almost without exception, the second primary is somewhat longer than the third, and in most instances the fourth is longer than the first, although the difference is often slight. Independent of wear, some specimens are darker than others; the upper parts vary from deep to dark mouse gray. In unworn plumage the wing-patch and inner secondaries are often very conspicuous, the hoary white edgings being especially prominent. The pale area on the under coverts of the wing varies in extent and in degree of whiteness, but is present throughout a series of one hundred and forty specimens, including one carrying remains of natal down. Albinistic feathers occur in several instances.

Three Academy specimens from Southeast Farallon Island, taken September 15, 1911, well illustrate the passage from the

[1] Condor, 1913, v. 15, p. 88.
[2] Cf. Proc. Calif. Acad. Sci., 2d ser., v. 6, p. 362.

natal down to the definitive feathers. Except on the naked region of the throat, No. 18686, female, is clad in natal down of a mouse gray color. On the body both the primary and secondary down are developed. No. 18685, male, is more advanced, and has definitive feathers, concealed by secondary down, on the breast, abdomen, back, rump, and wings. The rectrices are beginning to sprout. In color, the natal down is mouse gray and the definitive feathers of the upper parts deep mouse gray. No. 18684, male, retains only remnants of the natal down on the upper parts. The breast and abdomen, however, have a dense covering of secondary down, hiding the definitive feathers. Both in the down and definitive feathers the tone of the mouse gray is darker than in the preceding specimen.

While most of the year is poorly represented by specimens, the course of the moult appears to be well outlined in the large series before me. Two early April specimens have no growing feathers and a third taken May 20 has only a few of them. In a Farallon series of one hundred and eleven specimens, captured between May 31 and June 29, there is a little sporadic replacement progressing; otherwise moult is at a standstill. A complete renewal appears to be commencing in a specimen shot at sea on September 20; in one taken October 8 the headway is greater. Of eighteen specimens secured on November 1, ten are apparently birds-of-the-year with no feather growth under way, and eight are adults in full moult. Four of the latter still retain three of the outermost old primaries, one, four of these primaries, and three, five of them. The rectrices have been renewed, save in those retaining five old primaries. A specimen shot November 4 is very backward, and has lost only three of its innermost primaries. Another of the same date, apparently a bird-of-the-year, is not renewing any of its feathers.

Subjoined are the extreme and average measurements in millimeters of seventy-seven males and fifty-eight females.

	Sex	Wing	Tail	Culmen	Tarsus	Middle Toe and Claw
Maximum.....	♂	148	83	15.2	24	25.4
Minimum.....	♂	134	72	13.4	21.1	21.2
Mean.....	♂	142	77	14.3	22.7	23.7
Maximum.....	♀	152	86	15	25	25.1
Minimum.....	♀	138	74	13.1	21.3	22
Mean.....	♀	144	79	14.3	22.8	23.8

Detailed Measurements (in millimeters) of Specimens taken on Southeast Farallon Island on May 31 and June 1-2, 1911

No.	Sex	Wing	Tail	Culmen	Tarsus	Middle Toe and Claw
18015	♂	142	78	14	23.8	23.9
18018	♂	142	78	14	22.5	23
18019	♂	138	75	13.5	22.7	24
18020	♂	140	78	14	22.8	24.2
18023	♂	141	81	13.7	21.6	23.5
18024	♂	141	75	14	23	23.4
18027	♂	141	77	14	22.4	24
18029	♂	141	79	14	22.2	23.6
18030	♂	141	77	14	23	24
18031	♂	146	78	14.3	22.5	24
18033	♂	141	76	14.5	23.8	24.1
18034	♂	142	78	14.2	22.6	24.2
18035	♂	143	77	14.2	22	23.1
18037	♂	141	80	14.9	22.1	23
18038	♂	142	80	14.7	23	23.5
18063	♂	139	76	14	22.8	23.5
18065	♂	138	78	14.6	22.3	23.9
18066	♂	145	82	14.4	22.2	24.1
18067	♂	139	73	14	22.5	24.5
18069	♂	141	76	14.5	22	23.6
18071	♂	140	78	14.2	21.8	24
18016	♀	146	81	14.8	23	25
18017	♀	145	83	14	23	23
18021	♀	144	86	14.8	22.5	23
18025	♀	141	74	14.1	24	23.9
18026	♀	143	80	14.6	23.6	24.5
18028	♀	149	83	14.1	22.1	22.3
18032	♀	144	79	14.3	22.1	23.8
18036	♀	143	79	14.5	24	25
18039	♀	144	76	14.5	23.2	24.5
18062	♀	143	77	14	23.2	24
18064	♀	146	79	14.5	23	24
18068	♀	144	84	14	22	23.5
18070	♀	143	80	14.8	24	25

Forty-six eggs of the Ashy Petrel from Southeast Farallon Island are of an ovate, short ovate, elliptical ovate, or nearly elliptical oval shape. They are white, more or less marked with pink, rufous, or dusky specks, dots, and little splashes, which often form a zone or cap at the broader end. Occasionally the dusky and rufous specks are thickly distributed over most of the shell, and sometimes the white ground is nearly immaculate. The series measures in millimeters as follows: 31.8 x 22.5; 31.8 x 21.6; 31.4 x 22.9; 31 x 24; 31 x 22.9; 30.9 x 21.5; 30.6 x 23; 30.6 x 22.7; 30.5 x 23.3; 30.5 x 23; 30.5 x 22.9; 30.5 x 22.5; 30.4 x 22.4; 30.3 x 22.9; 30.2 x 23.1; 30.1 x 22.6; 30 x 23.4; 30 x 23; 30 x 23; 30 x 23; 29.9 x 23; 29.7 x 22.5; 29.6 x 22.3; 29.5 x 23; 29.5 x 22.6; 29.5 x 22; 29.5 x 22; 29.4 x 22.9; 29.4 x 22.4; 29.2 x 23.1; 29.2 x 23; 29.2 x 22.6;

29 x 23.1; 29 x 23; 29 x 23; 29 x 21.9; 28.6 x 22.8; 28.6 x 22.5; 28.6 x 22.5; 28.5 x 22.6; 28.5 x 22.4; 28.5 x 22.4; 28.5 x 21.6; 28 x 23.5; 28 x 22.6; 27.5 x 22.1.

Oceanodroma markhami (*Salvin*): MARKHAM'S PETREL

SALVIN—*Oceanodroma markhami*, 347, 354.
GODMAN—*Oceanodroma markhami*, xxxvi, 27, pl. 7.

A female was shot by Mr. R. H. Beck on August 1, 1905, in latitude 13° 28′ N. and longitude 108° 52′ W., and a male on September 1, 1905, thirty miles south of Cocos Island—about latitude 5° N., longitude 87° W. These captures extend the known range of this species into the Northern Hemisphere. The "types" (two females) came from the coast of Peru and remained unique until Mr. Beck's rediscovery of the species, more than twenty-one years after Mr. Salvin published his original description of it.[1]

Recently, Capt. R. Paefsler has recorded the occurrence of this petrel in December and February off the west coast of South America between latitude 9° and 23° S.[2] North of the Equator its status is probably that of a migrant from the Southern Hemisphere.

Both of the specimens taken by Mr. Beck are apparently having a complete renewal of plumage. Their measurements in millimeters are as follows:

No. 658; ♂; wing (moulting) 176; tail 94; culmen 18; tarsus 23; middle toe and claw 23.1.

No. 592; ♀; wing (moulting) 177; tail 92; culmen 18; tarsus 22.9; middle toe and claw 24.4.

Oceanodroma melania (*Bonaparte*): BLACK PETREL

COUES—*Cymochorea melania*, I, 76, 90.
SALVIN—*Oceanodroma melania*, 347, 353.
GODMAN—*Oceanodroma melania*, xxxvi, 24, pl. 6.

While the little schooner *Mary Sachs* was becalmed on the 10th, 11th, and 12th of August, 1903, fifteen to twenty-five miles west of Point Reyes, California, the ornithologists of the Academy's Revilla Gigedo Expedition saw many Black, Ashy, and Fork-tailed petrels flitting about over the ocean. A series

[1] P. Z. S., 1883, p. 430.
[2] J. f. O., 1913, v. 61, p. 49; 1914, v. 62, p. 277.

of specimens of the Black Petrel was secured, but was subsequently destroyed in the Conflagration of April, 1906.

Offshore in the vicinity of Point Pinos, California, Mr. Beck has taken Black Petrels at the end of May, in June, July, and August and during the first fortnight of September. On certain days late in July and late in August he found them common.

As is well known, this species occurs off Southern California and breeds on Los Coronados and San Benito islands, Lower California.

It is recalled that Prince Bonaparte in 1854 in his original account of this petrel attributed it to the fauna of California. After the lapse of more than sixty years, the extremes of its range and the character of its migrations still remain to be worked out. A female in worn plumage shot on July 25, 1905, in latitude 19° 40′ N. and longitude 112° W. was the last example secured by the Galapagos Expedition. Mr. C. H. Townsend has reported the capture of a single specimen on April 12, 1891, off Acapulco, Mexico.[1] It is not improbable, therefore, that the range of the Black Petrel in the south overlaps that of Markham's Petrel.

The Revilla Gigedo Expedition called at the San Benito Islands May 6, 1903, and Mr. Bunnell records in his diary of that day that he dug fifty of these petrels out of abandoned burrows of Cassin's Auklets; that two petrels usually occupied a burrow, but sometimes only one; that egg-laying had not commenced; that the petrels were very easy to kill, and leaked an orange-colored oil from the mouth and nose; that they were seen abroad only late at night; that their flight was bat-like. The Galapagos Expedition visited the San Benito Islands on the 14th, 15th, and 17th of July, 1905, but apparently failed to find eggs or downy young, although adult birds were found abundantly in old auklet burrows, and less numerously in crevices among rocks.

The usual point-of-wing-formula in the Academy's series of one hundred and fifty-one specimens is: primary $2>3>1>4$. In some instances, the interscapulars, scapulars, and tertials of specimens in good plumage are indistinctly margined with brown.

[1] Bull. Mus. Comp. Zool., 1895, v. 27, p. 126.